CP/M Version 2.2

for the

HEATH/ZENITH 8-Bit Computer Systems

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CHAPTER ZERO: INTRODUCTION TO CP/M

- **A general introduction to the CP/M operating system.**
- **A description of the manual organization.**
- **The required hardware environment.**
- **The basic differences between CP/M Version 2.2.02 and Version 2.2.03.**

In this Chapter you will find a brief introduction to and summary of the CP/M (Control Program for Microcomputers) Operating System designed by Digital Research. This release of CP/M has been supplemented by Zenith Data Systems, specifically to facilitate the use of Heath/Zenith hardware systems in a wide variety of both Business and Personal applications.

This chapter gives a brief summary of the basic organization of the manuals that form the body of this work--the first one, written by Heath/Zenith, and those that follow, written by Digital Research.

Except for the enhancements and changes described here, the version of CP/M supplied by Heath/Zenith is the standard operating system. In all cases, software that is guaranteed to run under CP/M 2.2 should run on the Heath/Zenith implementation, provided that the media format is compatible and that there is adequate memory and mass-storage capability. No special input or output devices (e.g., graphics terminals, paper tape reader or punch, light pens, etc.) are required by this version. The Digital Research manual, "An Introduction to CP/M Features and Facilities," provides a more complete description of this product.

The constant strides that have been made in hardware development by Heath/Zenith, require constant software updates to keep abreast of the new developments. This manual is released with Heath/Zenith CP/M Version 2.2.03 (the "2.2" being Digital Research's Version Number, and the " .03" being the Heath/Zenith implementation number). Version 2.2.03 has been released as an upgrade to Version 2.2.02 to support two additional types of disk drives, the Z89-37 (Soft-Sectored, Disk System) and the Z67 (Ten-Megabyte, Winchester Disk System), and to provide more flexibility in interfacing to different types of printers.

> NOTE: Throughout this manual an abbreviated notation has been used for all of the disk drives and disk drive controllers that are supported by this release of CP/M. Z37 is used both when discussing the Z37 drives and the Z89-37 drive controller; Z67 is used for both the Winchester System (Z67) and its interface (H/Z89-67); H/Z47 is used also for the H/Z89-47 interface; and H/Z17 is used for the H/Z89-17 controller, which is also used with the H/Z87 and H77.

If this is your first exposure to CP/M, Chapters One through Five should be very useful to you. Their purpose is to introduce the use of CP/M and in the process provide an overview of the use of the H/Z89 or the H8.

Once you are familiar with the operation of CP/M, if you should wish to do some customization to suit a particular peripheral device, or to optimize the operating system's performance on your hardware configuration, chapters Five through Eight should be studied carefully.

Section One: General Introduction

A basic operating system takes hardware-specific routines that all programs necessarily have in common and arranges those routines in a way that a programmer or user may call on them when they are needed. The programmer/user does not need to write each instruction into the program each time it is required. A simplified definition of an operating system might be that it allows the user to tell the computer "what" it should do without needing to tell the computer "how" it is supposed to do it.

The user is freed from the burden of having to understand the details of the underlying hardware and how it performs its functions. Some examples of this type of hardware-specific routine might be: a method of accepting input from the user, a method of providing an output to the user, and a file management system that allows some type of data storage and retrieval.

The CP/M operating system provides a common interface to a large variety of computer hardware. It does this by orchestrating the software's control and access of all system hardware. CP/M builds a standardized machine in software out of the available hardware. This ability has facilitated the production of a wide array of application software that can run under CP/M. This is because the software and hardware interaction is standardized by CP/M, despite any physical differences that exist between the various types of hardware that are available.

A comprehensive file management scheme built into CP/M permits rapid access to programs and data stored on disk. Files are allocated dynamically, and both sequential and random access is permitted. CP/M also provides a level of independence for peripherals (terminal, printer, modem, etc.), permitting the output of a program to be directed to different serial devices from the command level.

This manual is designed to provide an introduction to the use of CP/M 2.2 on the Heath/Zenith equipment. This release of the industry standard operating system, CP/M, implements all of the basic features. As time goes on, Heath/Zenith will successively introduce revisions that include support for more hardware products and configurations, as well as general improvements in performance.

Version 2.2.03 of CP/M requires at least 32K of random access memory in a Zenith Data Systems Z89 or a Heath H89 or a Heath H8. It supports up to six logical disk drives on the H/Z89 and up to five disk drives on the H8 (at least one drive is essential). Section Four on page 6, details the differences between Heath/Zenith Version ".03" and the previously released version ".02".

Section Two: Manual Organization:

The organization of this manual is based as much as possible on a logical order for use of the CP/M utilities--those created by Digital Research and those created by Heath/Zenith. This manual begins with a brief description of the CP/M Operating System and the utilities that it provides the user. A basic description of the hardware configurations that are supported by this release is then covered, though most of the hardware configuration information is contained in the operating manuals that are provided when each item is purchased. Particular attention should be paid to the Hardware manuals for connection and configuration of the physical system.

Directly after the Hardware description is a chapter on beginning--how to boot the system, create backup copies of disks, and the general starting procedures. Next, the utility programs written by or modified by Heath/Zenith are explained, with illustrations of how they may be used. Each of these utility programs will be covered step by step, wherever practical, within the text. Once these steps are learned CP/M will become an extremely easy-to-use tool.

Following this manual and completing this set of manuals, are the manuals written by Digital Research. The Digital Research manuals provide additional understanding of the design and functions of CP/M. The section by Digital Research also contains manuals that are devoted to the complete explanation of the standard utilities found in CP/M. Finally, Digital Research has included a basic alteration guide to explain those portions of the user-interface structure that may be customized so that the operating system is more suited to the operating environment and needs of the user.

Section Three: Hardware Awareness

The possible configurations for an operating environment expand as the available types of hardware increase. The intent of this manual is to describe the utilization of the operating system insofar as it coordinates all of the functions of the hardware in its particular configuration. It is also intended to make the user aware of the range of possible hardware configurations that CP/M is capable of orchestrating, and how it may best be implemented to do so.

It is NOT the intention of this manual to replace the manuals that are provided with any computer or peripheral, nor to explain how to assemble and interconnect all of the various components that may be used; these details have been given specific and intensive coverage in the manual for each device. To cover those details here would make this manual difficult to use, as well as cause the user to search through the many pages that would be necessary for the particular instructions applicable to the system that the user has assembled.

For the actual installation and interconnection instructions for the various types of hardware, the user should consult the specific hardware manuals involved. Appendix B, on page 118, details what hardware configurations are necessary for a minimal system, and what hardware is supported. It includes a list of the physical components that are required by each one of those systems to provide a complete system that is supportable under this version of CP/M.

Section Four: Version 2.2.02 Versus 2.2.03

The main differences between these two Heath/Zenith implementations of CP/M are centered on the addition of programs to support the Z37 5.25-inch soft-sectored disk controller, and the Z67 Winchester Disk System. CP/M has been enhanced to handle the additional input and output operations that these devices require. New utilities have been added to make it easier for the user to operate the system and achieve the desired results.

Additional input and output functions have been designed so that a wider variety of printers may be utilized with fewer modifications.

One specific item of some note has changed that did not exist in the previous implementation. A label has been added in code to the data on the disks. The label has been created to allow CP/M to determine the media type and density of a disk when it reads the system tracks into memory. This label resides on Side 0, Track 0, Sector 1 of the disk. The label is written during FORMAT to the Z37 and the Z67 Winchester Disk (not to the Z67 floppy); and written to H/Z17, H/Z47 disks and Z67 floppy disks when they are Sysgened. This method makes disks that have been created with previous releases of CP/M compatible and allows the user to use previously generated disks that do not have this label. This is, of course, more meaningful and useful to the experienced programmer who wants to make modifications, rather than to the general user or first-time initiate.

CHAPTER ONE: IN THE BEGINNING

- How to Handle and Take Care of Disks.
- Boot Up Procedure for the Primary Device.
- Boot Up Procedure for the Secondary Device.
- The Standard System Configuration of the BIOS.
- Step-by-step Creation of a Backup Copy for the First Time User.
- An Example of how the System is Typically Used.
- The Basics in Optimizing a System.

In this Chapter all of the "first-things" will be covered. It contains everything that you will need to do "first-thing", before anything else. Even if you have previous experience with CP/M, much of what will be presented here will be specific to this release of Heath/Zenith CP/M and should be reviewed before proceeding further.

The first thing you must do upon receipt of this CP/M system is to read the enclosed Digital Research license agreement. Then complete the End User License Agreement and return it to Zenith Data Systems. The postal card should be completed and returned to Digital Research.

The serial number on the system disk (or disk set, if you purchased CP/M on 5.25 media) is your license to use CP/M on a single computer. The registration card insures that you will receive information concerning updates and revisions to this software.

Section One: Disk Handling Procedures

Disks are somewhat fragile and should be handled accordingly. There are a few common sense rules that should be followed. Some of these rules, only apply to floppy disks though the Winchester Disk should also be considered quite fragile even though it is totally enclosed. You'll know that the old cliche is true once a disk has been ruined by a careless act: it is far better safe than sorry!

Information is stored on the disk magnetically, so keep magnets and magnetic objects away! The surface of the disk should remain clean, do not touch the recording surface of the disk, and keep it in its protective envelope when not in use. A portion of the disk is exposed through the aperature that the read/write head of the disk drive accesses the recording surface (see: Appendix E, figures E-4 and E-5 to identify the Read/Write Head Aperature). The envelope protects the exposed portion of the recording surface of the disk. Store disks flat and in a cool place to avoid deforming the plastic.

Keeping your disks clearly labeled is important in helping you quickly find a desired file. Always prepare the label before affixing it to the disk to keep your writing instrument from marring the disk.

Write Protection

You can "write-protect" a 5.25-inch disk by putting one of the special foil tabs (these usually come with newly purchased disks) over the notch in the side of the disk. Don't use cellophane or other types of tape! Tape can get adhesive on the disk's recording surface. An 8-inch disk can be write protected by removing the tab from the notch in the side of the disk (the exact opposite of the procedure for the 5.25-inch disk). This is illustrated in Appendix E, Figures E-2 through E-5 on pages 127 through 128.

The Winchester disk has no means to mechanically write protect it. All protection of the Winchester disk must be performed either by selecting electronic write protection, by setting the write protect switch on the Z67 (the 8-inch floppy disk also has this capability) to Read/Only, or with software by utilizing CP/M's write protection facilities. For specific information on these facilities, refer to pages 5 and 6 of the manual written by Digital Research that is entitled "CP/M 2.0 User's Guide For CP/M 1.4 Owners". Additional information may be found in the Digital Research manual "An Introduction to CP/M Features and Facilities"; specifically, refer to the "STAT:" command where the temporary protection option is described on page 14.

As an additional precaution, it is also advisable to take floppy disks out of the drives during power-on and power-off to prevent any accidental writing on the disk. This is recommended because transient voltages occur when a power switch in a circuit is opened or closed. These transients can act as a phantom command to read or write to the disk, damaging data that might be stored there.

In spite of all precautions, disks can still become damaged. It is a good idea to "back-up" your files as often as is practical by duplicating the disk(s) you are working with and storing the duplicates in a safe place. Then if something should happen to your original disk, you can restore your files from the last time you made a back-up. Making a back-up is covered below under "Section Five: Creation of a Backup", on page 16.

Systems that utilize an Z67 may also use BRS.COM (Backup and Restore System Utility) for backup creation. This utility is covered in Chapter Five on page 67.

Section Two: Booting from the Primary Device: The Cold Boot

For The H/Z89:

The H/Z89 computer allows the user to boot from either a 5.25-inch disk, an 8-inch disk (if either an H/Z47 or an Z67 disk accessory is attached), or from a Winchester disk (if the Z67 is attached) after the Winchester disk has been partitioned. In any case, the initial boot will be accomplished from the device that is selected as the primary disk drive in the system. Switch SW-501 on the CPU Logic Board inside the H/Z89 determines what the primary drive in your system is. (See Figure C-2 on page 124, Switch Configuration on page 122 and the H/Z89 operations manual for details).

The primary drive for an H/Z89 is typically set to the 5.25-inch drive located on the front of your computer, to the right of the display screen.

Follow these steps:

1--Turn on your H/Z89 computer and your disk drive accessory (if attached).

2--Then insert the disk labeled "CP/M Distribution Disk I" into the primary disk drive for your system.

The disk is inserted with the label side toward the door, and the long slot in the disk envelope toward the rear of the machine. This is illustrated in Appendix E (figure E-1).

> NOTE: If the primary drive is the Z67, place the disk into the floppy drive (assuming you bought the 8-inch media).

3--Carefully close the door of the disk drive when the disk has been fully inserted.

When the terminal display has warmed-up, it will display an "H:" prompt in the upper left corner of the screen.

4--Type B (or lower case "b").

> NOTE: If the primary drive is the Z67, type B1. The computer will complete the command by spelling the word "Boot 1". This will boot the 8-inch floppy disk drive.

5--Then press the RETURN key.

The disk drive should become active, indicated by a small red light located on the front of the drive. The computer is now reading in the CP/M operating system.

After a short period the computer will display the message:

```
32K Heath/Zenith CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

where the "03" is the current implementation number of the software, and "32K is the amount of memory that CP/M is currently configured for (this does not signify that there is only 32K of memory in the computer; if "32K" is smaller than the actual memory size of the computer, CP/M will need to be told differently; see: Section Six "System Optimization" for further details). The "type" will be the disk type(s) that the BIOS is configured for, and the "code" will show the options that are currently selected (more information on the option "code" is given on page 112 under "BIOS Options"). The Configuration program begins automatically at this point and its beginning display will appear. (The Configuration Utility is covered on page 92.)

You have now successfully booted CP/M! This procedure is referred to as a cold-boot.

If the message does not appear, you may try again by:

1--pressing the SHIFT key located on the righthand side of the keyboard, and

2--simultaneously pressing the RESET key.

This will return your computer to the "H:" prompt, so that you may reattempt to boot.

For The H8:

You must have the Extended Configuration Option (H8-8-8) or the Z-80 CPU board (Ha-8-6) installed in your H8 in order to run this version of CP/M. When you install the modification, you will determine whether 8-inch floppy disk drives (H/Z47) or 5.25-inch floppy disk drives (H/Z17) will be the primary device in the system (see the manual for the Panel Monitor XCON-8 for details). If an H/Z17 and an H/Z47 are both used, one will be designated as the primary device and the other will be the secondary device. With either type of device, the primary drive (drive A:) will be located on the left.

Follow These Steps:

1--Turn on your H8 computer, terminal, and any disk drives connected to the system.

Allow the video terminal to "warm up" until the cursor is visible.

2--Insert the disk labeled "CP/M Distribution Disk I" into the primary disk drive for your system.

The disk is inserted with the label side toward the door, and the long slot in the disk envelope toward the rear of the machine. This is illustrated in Appendix E.

3--Once the disk is fully inserted, carefully close the door of the disk drive.

4--Press the number "1" key on the front of the H8. The display on the front of the H8 should read

```
Pri H 17
```

if you are using an H/Z17 as your primary device. If you are using an H/Z47 as your primary device, the display on the front of the H8 should read

```
Pri H 47
```

The disk drive should become active, indicated by a small red light located on the front of the drive. The computer is now reading in the CP/M operating system.

After a short period the computer will display a message such as:

```
32K Heath/Zenith CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

where the "03" is the current implementation number of the software, and "32K is the amount of memory that CP/M is currently configured for (this does not signify that there is only 32K of memory in the computer; if "32K" is smaller than the known memory size of the computer, CP/M will need to be told differently; see: Section Six "System Optimization" for further details). The "type" will be the disk type(s) that the BIOS is configured for, and the "code" will show the options that are currently selected (more information about the options code is given on page 112 under "BIOS Options"). The Configuration program begins automatically at this point and its beginning display will appear. (The Configuration Utility is covered on page 92.)

You have now successfully booted CP/M! This particular method of booting is referred to as a cold-boot.

If the message appears garbled, you are probably using an unexpected baud rate. This situation is easily remedied by typing a few spaces on the space bar of your terminal to let the system know what baud rate is being used.

If no message appears, you may try pressing the space bar a few times, in case of an unexpected baud rate.

If no message has appeared after typing the spaces, depress the "0" key on the front of the H8 simultaneously with the "RST/0" key. This will reset the computer and allow you to try the boot again.

Section Three: Booting from the Secondary Device: The Cold Boot

Insert the Distribution Disk ("Volume I" if your disk set is on 5.25-inch media) into the leftmost drive of your secondary device for the following steps.

For The H/Z89:

If your H/Z89 has multiple drives connected to it, you have the option of booting from a device that is not specified as the primary device. To do this, the user should:

1--Type B

As before, the computer will complete the command spelling the word "Boot".

2--Now type S

> NOTE: If the Z67 is set as the secondary device, you will also need to type a 1 after the "S", so that the floppy in the Z67 is activated (assuming that you purchased the 8-inch media).

The computer will complete the command by displaying "SD", which indicates the boot is to occur from a secondary device.

3--Press the RETURN key.

The remainder of the boot process occurs as described above in Section Two.

For The H8:

If you have an H/Z17 and an H/Z47 connected to your system, you have the option of booting from a device that is not designated as the primary. Then do this:

1--Press the number "2" key on the front of the H8 instead of the number "1" key.

The display on the front of the H8 will read

```
SEC H 17
```

if the H/Z17 is the secondary device, or

```
SEC H 47
```

if the H/Z47 is the secondary device.

The remainder of the boot process is identical with the boot from the primary device listed above in Section Two.

Section Four: Standard System Configuration

Directly after the system is cold booted, a program begins to automatically run. This program is the Configuration Utility (listed as CONFIGUR.COM on the Distribution Disk) and is used to set up, change, or modify the configuration of the CP/M operating system to match a particular hardware environment. When it begins the terminal will display something similar to:

```
32K HEATH/ZENITH CP/M 2.2.03
FOR Z67 DISKS WITH OPTION(S) P2I
    HEATH/ZENITH CONFIGURATION PROGRAM
    VERSION 2.2.03
    SERIAL NUMBER: nnn-nnnnnn

    THIS PROGRAM CONFIGURES THE CP/M OPERATING SYSTEM TO A
    PARTICULAR HARDWARE ENVIRONMENT.

    PLEASE WAIT DURING HARDWARE VERIFICATION...

    H/Z89 WITH 64K OF RANDOM ACCESS MEMORY  (RAM)
    Z67 8 INCH HARD/FLOPPY DISK INTERFACE
    CRT BAUD RATE IS 9600
    00 ADDITIONAL PORTS FOUND

    DRIVE A DISK IS WRITE PROTECTED.
    MODIFICATIONS WILL NOT BE MADE TO THE DISK FOR THIS CONFIGUR RUN.


    STANDARD SYSTEM (Y OR N)? <Y>:
```

This configuration utility is detailed in Chapter Six of this manual, on page 92. Until this manual has been completely read, your response to the

```
    STANDARD SYSTEM (Y OR N)? <Y>:
```

prompt should be either just a **Y**, or by pressing **RETURN**. CP/M will then display the command mode prompt (A>). Do not ask for a non-standard system by typing **N** until you have completed Chapter Five. A "standard system" configuration may not use all of your existing hardware to its optimum but it will not need to do so until you have a firm grasp of CP/M.

The Standard System Configuration values that will be set in the BIOS (when you type **Y** or press **RETURN** to the prompt) are shown on page 96.

Section Five: Creation of a Backup

It is extremely important to maintain a backup copy of your Distribution Disk (or Disk Set), and for the first time user of CP/M it is perhaps even more important. Though CP/M is easy to use once it has been learned, the learning process does take some time and so this section was created to guide you through the generation of a backup copy with a minimum of effort and only a minimal knowledge of this operating system.

The first need is to determine what type of operating environment is being used (what equipment does the total system consist of and now is it configured). Next, dependent upon that operating environment, a series of procedures is outlined. Each procedure is a list of steps that need to be performed to create a backup disk. The operations that are performed while following these steps are not explained with any detail where they occur in the step-wise procedure, but they are all explained further on in the appropriate sections of this manual.

Drive Name Determination:

There is one more thing that needs to cover before continuing with the creation of a backup copy. The drive name assignment for the drives need to be determined (unless you have only a single drive system, in which case the drive name is "A:"). The drive that the boot is performed on is always Drive "A:"!

For the HEATH/ZENITH H/Z89 Computer:

Boot Device Names Possible:

H/Z17	A:, B:, C:	Z37	A:, B:, C:
H/Z47	A:, B:	Z67	A:, B:, C:

(See "Appendix F" for Illustrations of Drive Name Designation.)

> NOTE: Only one Primary Device and one Secondary Device may be connected to the computer. A system can support only two device types. In the table below, the three devices that are given below each "booted device" are the three alternate device possibilities. Only one of the three may be used in conjunction with the "booted device".

Initial Boot to H/Z17
Secondary Device Names

H/Z17	A:, B:, C:	(Booted Device)
Z37	D:, E:, F:	
H/Z47	D:, E:	
Z67	D:, E:, F:	

Initial Boot to Z37
Secondary Device Names

Z37	A:, B:, C:	(Booted Device)
H/Z17	D:, E:, F:	
H/Z47	D:, E:	
Z67	D:, E:, F:	

Initial Boot to H/Z47
Secondary Device Names

H/Z47	A:, B:	(Booted Device)
H/Z17	C:, D:, E:	
Z37	C:, D:, E:	
Z67	C:, D:, E:	

Initial Boot to Z67
Secondary Device Names

Z67	A:, B:, C:	(Booted Device)
H/Z17	D:, E:, F:	
Z37	D:, E:, F:	
H/Z47	D:, E:	

For the HEATH H8 Computer:

Boot Device Names Possible:

H/Z17	A:, B:, C:	H/Z47	A:, B:

Initial Boot to H/Z17 Secondary Device Names

H/Z17	A:, B:, C:	(Booted Device)
H/Z47	D:, E:	

Initial Boot to H/Z47 Secondary Device Names

H/Z47	A:, B:	(Booted Device)
H/Z17	C:, D:, E:	

Perform a cold boot on your system, exactly as covered in "Section Two" above. The terminal on your system will display,

```
32K HEATH/ZENITH CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

and then it will continue with the Configur program, giving the display that is shown in "Section Four: Standard System Configuration". After answering "Y" for a "Standard System", CP/M will display:

```
A>
```

The "A>" is CP/M's Command Mode prompt. It lets the user know that CP/M is awaiting a command from the user.

The following is not the best way to determine the name assignments of each drive in your system but it is quick.

Place disks in all of your drives, close the drive doors and type in B: and press RETURN, thus:

```
A>B:      RETURN
```

Watch the small lights on all of your drives to see if any of the drive-active lights come on. The drive with the light that comes on briefly is the drive named "B:". If either no disk or a disk that has not been properly initialized has been inserted into drive B:, a BDOS select or bad sector error will occur. Pressing RETURN or CTRL and C in the event of this error, will return the system to the A: drive. These errors also will occur here if the drive door is left open.

NOTE: The Winchester Disk in the Z67 system does not have a drive-active light. No name assignment will have been made until after the ASSIGN command has assigned a drive name to at least one resident partition. This drive usually makes soft clicking noises when it is being accessed but the major report of its activity will be by what is displayed on the monitor.

When a properly intialized disk is inserted and the door is closed on the "B:" drive, the screen would show a new prompt:

```
B>
```

Depending on which drive has been "logged on", the command mode prompt will reflect the name assigned to the logged drive.

This release of CP/M considers logical drive names A: through F: to be valid though you must have one to six corresponding drives connected and with their power switch set to "ON" for these names to be recognized. If your system has three drives connected, the names "A:", "B:", and "C:" would be the valid drive names. (See: "NOTE", above, if you have an Z67. If you Boot up on the 8-inch drive of the Z67, it will be the "A:" drive. The Winchester disk in the Z67 has no name assignment until after you have run the ASSIGN utility.)

To log on another drive, type in X: (where "X" is the corresponding drive name) and press **RETURN**. Take a moment and do this using the names "A:" though "F:" to determine what the names of each of your drives are.

> NOTE: If you performed a cold boot on the Primary Device, the physical drives will be assigned different names than if you performed a Secondary-Device cold boot. The specific drive that a boot is performed on is always designated as Drive A:. (See "Appendix F" for Illustrations of Drive Name Designation.)

If a drive name is requested for a drive that does not exist, is not connected to the system, or does not have a disk in it, a BDOS error message will appear:

```
BDOS Err on X: Select
```

In this prompt, "X:" is the drive name that was requested by the user. This error state may generally be exited if the user presses **RETURN**.

Backup Procedure Determination:

Depending on which particular operating environment you have, you will use one of three procedures. To determine which procedure to follow, look at the following sets of questions to see which of the three types your system is considered to be:

- Do you have only one individual disk drive, or more than one disk drive but none of them use the same controllers? Follow "Backup Procedure One", on page 21.
- Do you have more than one disk drive, where at least two of the drives use identical media (the same type of disks)? Follow "Backup Procedure Two", on page 24.
- Do you have only an H/Z89 computer and an Z67 Winchester Disk System? Follow "Backup Procedure Three", on page 27.

Backup Procedure One: Single Disk Drive Systems

Cold-Boot

1--Perform a Cold-Boot, as was covered above.

The Computer will respond with:

```
    32K HEATH/ZENITH CP/M 2.2.03
    FOR{type} DISKS WITH OPTION(S){code}
```

and then continue with the Configuration program.

Configuration

2--After you see the prompt, type **Y** to ask for a "Standard System" (see: Section Four, above). The computer returns to the command mode and displays:

```
      A>
```

FORMAT

3--Type in **FORMAT** and press the **RETURN** key.

The FORMAT program will display a few sentneces and then ask you "Is that what you want? (y/n):". The "(y/n)" means that it expects a "yes" or a "no" answer from the user.

4--Type in a **Y**.*

FORMAT will ask "Which drive do you wish to use for this operation?:".

5--Remove the disk that is in the drive.

6--Place a blank disk into the drive you just removed the Distribution Disk from.

7--Close the drive door securely.

8--Type **A** and press **RETURN**

If your disk drive controller is an H/Z17, the following two questions will not appear. Skip over them and go to step 11. If the disk drive controller is a Z37, you will be asked "Which Density?".

---

* By convention in Heath/Zenith software all responses to prompts should be terminated by a **RETURN** with the exception of the requests ending in ":".

9--Type S

If the disk drive controller is a Z37, the program will ask "Number of Sides?".

10--Type 1

The drive light will indicate that the drive is active. There will be a pause while the program formats the disk. When it has finished, FORMAT then asks "Do you have more disks to format? (y/n):"

11--Type N, unless you have more than one disk to backup. (If your Distribution Disks are on 5.25-inch media, you will want to copy each of the three disks in the set. For multiple copies, return to step 4 and type Y)

FORMAT will tell you to "Place a bootable disk in drive A and press any character:".

12--Retrieve the disk just formatted from the drive and replace it with the Distribution Disk.

13--Press **RETURN**

You will now see the CP/M Command Mode prompt:

```
A>
```

SYSGEN

14--Type **SYSGEN** and press **RETURN**

SYSGEN will ask "SOURCE DRIVE NAME (OR RETURN TO SKIP):".

15--With the Distribution Disk in the drive, type **A**

SYSGEN will state "SOURCE ON A, THEN TYPE RETURN".

16--Press **RETURN**

SYSGEN will pause, then ask "COPY BIOS.SYS (Y/N):".

17--Press **N**. Do Not Hit the "RETURN" key!

SYSGEN will pause briefly this time, and then ask "DESTINATION DRIVE NAME (OR RETURN TO REBOOT):".

18--Remove the Distribution Disk, and replace it with one you have just formatted.

19--With the drive door closed, type **A**

SYSGEN responds "DESTINATION ON A, THEN TYPE RETURN".

20--Press **RETURN**

21--When SYSGEN asks "DESTINATION DRIVE NAME (OR RETURN TO REBOOT):", replace the newly "sysgened" disk with the Distribution Disk. Or if you have more disks to be "sysgened", return to step 18 and repeat the process with another disk.

22--Press **RETURN**

PIP

23--Type PIP B:=*.*[R]

24--Press **RETURN**

PIP will cause all of the files on the disk to be copied onto the disk that you formatted and sysgened. It will read information from the distribution copy, store that data in memory, and then request that you "Place Disk B in Drive A: then press RETURN." The "Disk B" that it refers to is the new one you are creating. It will then ask for disk A.

Alternate the disks back and forth when it requires you to do so. Be certain that you always place Distribution Disk I in the drive when it asks for disk A; and that you place the disk that you are using to make a copy, in the drive when it asks for disk B.

> CAUTION: Do not touch the keys on the keyboard, except the RETURN key and then only when you are asked to do so, while this operation is taking place. Doing so may cause the PIP operation to abort and you would have to start PIP again.

As PIP copies each file over, it will tell you the name of the file that is being copied. When it has completed, you will see the "A>" prompt again. At this point you will have made your first Backup copy. If you have 5.25-inch media, you will need to PIP the files from each of the three Distribution Disks to three different "formatted" and "sysgened" disks. Return to step 23 until all of the Distribution Disks have been copied.

Ending

25--Store the original Distribution Disk(s) in a safe place.

26--Prepare a label for the new disk. Be certain to include the required copyright information.

Now, go on to "Section Six: Typical System Use" page 33, for a further discussion of CP/M.

Backup Procedure Two: **Multi-Drive Systems with Identical Media**

Cold-Boot

1--Perform Cold-Boot, as was covered above.

The Computer will respond with:

```
32K HEATH/ZENITH CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

Then the Configuration program will begin automatically.

Configuration

2--Type Y in response to the "Standard System?" prompt.

Throughout this particular procedure, the drive containing the Distribution Disk will be referred to as the "Source" drive. The other drive, using identical media, will be referred to as the "Destination" drive.

FORMAT

3--Type **FORMAT** to the prompt shown.

For example, when you type in "FORMAT", it would appear as:

```
A>FORMAT
```

4--Press the **RETURN** key.

```
A>FORMAT     RETURN
```

The screen will display a few sentences, and then ask "Is that what you want? (y/n):"[#]

The (y/n) signifies that a "yes" or "no" answer is required by the question.

5--Type Y. Do Not press **RETURN**!

FORMAT will then ask you "Which drive do you wish to use for this operation?:".

6--Type in the character name of the drive where your destination disk is located.

[#] By convention in Heath/Zenith software all responses to prompts should be terminated by a **RETURN** with the exception of the requests ending in ":".

If an H/Z17 disk drive controller is being used for this operation, the next two questions will not appear. Skip over to step 9, if you are using an H/Z17 controller.

If you are using either the Z37 or the H/Z47 disk drive controllers, FORMAT will ask "Which Density?".

7--Press S.

If you are using either the Z37 or H/Z47 disk drive controllers, FORMAT will then ask "Number of Sides?".

8--Type 1.

There will be a pause while your disk is being formatted. The destination drive should indicate that it is active. It also will make a bit of noise during the operation.

FORMAT will next ask "Do you have more disks to format? (y/n):". If you have more than one disk to copy, return to step 5 and type Y. If you have only one disk to copy, proceed with step 9.

9--Type N.

FORMAT will then tell you to "Place a bootable disk into into drive A and press any character:".

10--Press RETURN.

CP/M will now show the prompt:

```
A>
```

DUP

11--Type DUP (followed by pressing the RETURN key).

The program will identify itself, and display a list of options.

12--Select option "A", "copy and verify", by typing A.

13--When asked for the source unit, type A

This is the lettername ofthe source unit.

14--When asked for the destination unit, type in the character determined as the destination unit name.

> NOTE: If an 8-inch disk is being used as the destination, it must be write enabled by placing one of the tabs that are especially provided from the manufacturer with blank disks over the notch in the side of the disk. Do not use tape! Tape can get adhesive on the disk's recording surface. The sensor also uses an infrared LED, and many tapes are transparent to infrared so it may treat the disk as if the tape were not there.

15--Now place a blank disk of the same size and density as the Distribution Disk, into the Destination drive.

16--Close the drive door.

17--Press **RETURN** to begin the copying operation.

The disk drives will become active as the entire disk is duplicated.

Repeat this operation by returning to step 12 for each of the Distribution Disks (if they are on 5.25-inch media). Insert a different Distribution Disk and a different destination disk each time you repeat this procedure.

18--After the copy and verification operations are complete for all the disks, remove both disks and place "Distribution Disk I" in the A drive. Type Z.

Ending

19--Store the original Distribution Disk in a safe place.

20--Prepare a label for the new disk. Be certain to include the required copyright information.

Now, go on to "Section Six: Typical System Use", page 33, for a further discussion of CP/M.

Backup Procedure Three: Z67 Winchester Disk Systems

PART

1--Perform PART (if it is not already done), the partitioning program that was provided with the Z67 Winchester Disk System. This is the only step in this procedure that requires external information. The instructions for PART are in the manual that came with the floppy disk that was provided with the Z67. After PART is performed, you will need to place the Distribution Disk into the floppy drive of the Z67 then continue with this procedure.

Cold-Boot

2--Perform a Cold-Boot, as was covered above.

The Computer will respond with:

```
    32K HEATH/ZENITH CP/M 2.2.03
    FOR{type} DISKS WITH OPTION(S){code}
```

Then the Configuration program will begin automatically.

Configuration

3--Type Y in response to the "Standard System?" prompt.*

Throughout this particular procedure, the floppy drive containing the Z67 Distribution Disk will be referred to as the "Source" drive. The other drive, the hard disk, will be referred to as the "Destination" drive.

ASSIGN

4--**ASSIGN ?** followed by a **RETURN** is then typed in by the user.

The computer will respond with something similar to:

```
                                           MAXIMUM
              PARTITION NAME        OCCURRENCE NUMBER
         --------------------------------------------------
                   CPM                        2
```

which shows that the user set boundaries with PART, the Partitioning Utility, for three seperate partitions--**CPM;0**, **CPM;1**, and **CPM;2**.

---

* By convention in Heath/Zenith software all responses to prompts should be terminated by a **RETURN** with the exception of the requests ending in ":".

NOTE: This is only an example of the display that a user receives. The "Partition Names" that show on the display would be those names that were Assigned by the user during PART's operation. If multiple partitions were not named with the same name, then the maximum occurrence number for each partition name would be 0 (zero). If the same name were used for two different partitions, 1 (one) would be the maximum occurrence number. If the name were used on three partitions (as was the case for this example), then 2 is the maximum occurrence number. The first occurrence of a name is always 0 (zero), the second occurrence is 1 (one), the third is 2 (two), the fourth is 3 (three), and so on.

5--Select a CP/M partition for this operation.

6--Type **ASSIGN B:=partition-name;n** and press the **RETURN** key.

Here, "partition-name" must be the name of a partition, which was shown during Step 1, that you have decided to use. The "n" is the occurrence number that is shown for that particular partition.

7--Type **ASSIGN** and press **RETURN**

This should list the partition that you have just assigned and any that you may have previously assigned. An example might be:

```
A>ASSIGN

B: = CPM
```

Device "B:" will be your Destination Drive during the next procedure.

FORMAT

8--Type **FORMAT** to the prompt shown.

For example, when you type in "FORMAT", it would appear as:

```
A>FORMAT
```

9--Press the **RETURN** key.

```
A>FORMAT     RETURN
```

The screen will display a few sentences, and then ask "Is that what you want? (y/n):"

The "(y/n)" signifies that a "yes" or "no" answer is required by the question.

10--Type **Y**.

FORMAT will the ask you "Which drive do you wish to use for this operation?:".

11--Typein B

The computer will request "PRESS RETURN TO BEGIN."

12--Press **RETURN**

There will be a pause while your disk is being formatted. The destination drive should make a slight noise during the operation, which will let you know that it is operating.

FORMAT will next ask "Do you have more disks to format? (y/n):".

13--Type **N**.

FORMAT will then tell you to "Place a bootable disk into into drive A and press any character:".

14--Press **RETURN**.

CP/M will now show the prompt:

```
A>
```

SYSGEN

15--Type **SYSGEN** and press **RETURN**.

SYSGEN will ask "SOURCE DRIVE NAME (OR RETURN TO SKIP):".

16--With the Distribution Disk in the drive, type A.

SYSGEN will state "SOURCE ON A, THEN TYPE RETURN".

17--Press **RETURN**

SYSGEN will pause, then ask "COPY BIOS.SYS (Y/N):".

18--Press **N**. Do Not Hit the "RETURN" key!

SYSGEN will pause briefly this time, and then ask "DESTINATION DRIVE NAME (OR RETURN TO REBOOT):".

19--Type B

SYSGEN responds "DESTINATION ON B, THEN TYPE RETURN".

20--Press **RETURN**

After a few moments SYSGEN will ask "DESTINATION DRIVE NAME (OR RETURN TO REBOOT):".

21--Press **RETURN**

CP/M will again display the command prompt "A>".

PIP

22--Type PIP **B:=A:*.*[R]** and press **RETURN**

PIP will transfer all files from the Source Drive, "A:", to the Destination Drive, "B:". The name of each file will be printed on your monitor as PIP begins to transfer it. Unlike DUP, PIP may be used to transfer data between any type of media.

Cold-Boot

23--When the command mode prompt ("A>") appears again on your monitor, place a blank disk into the floppy side of the Z67.

24--Perform a cold boot on the Winchester Disk in the Z67.

The Computer will respond with:

```
32K HEATH/ZENITH CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

Then the Configuration program will begin automatically.

Configuration

25--Type **Y** in response to the "Standard System?" prompt.*

The Winchester disk will now be the "A:" drive.

FORMAT

26--Type **FORMAT** and press **RETURN**.

FORMAT will print a few beginning statements and then ask "Is that what you want? (y/n):".

27--Type **Y**

FORMAT then asks "Which drive do you wish to use for this operation?".

28--Type the drive name now assigned to the 8-inch floppy of the Z67, **C**

FORMAT will ask "Which Density?".

29--Type **S**

FORMAT will tell you to place the disk to be formatted into drive C:.

30--Press **RETURN** to begin.

After the disk is formatted, FORMAT will ask "Do you have more disks to format?".

31--Type **N**

CP/M will return to the command mode prompt, displaying:

```
A>
```

SYSGEN

32--Type **SYSGEN** and press **RETURN**.

SYSGEN will print out a couple of sentences and ask "SOURCE DRIVE NAME (OR RETURN TO REBOOT)".

33--Type **A** and press **RETURN**.

SYSGEN will next ask "COPY BIOS.SYS (Y/N):".

34--Press **N**. Do not press **RETURN**

After a moment SYSGEN will prompt with "DESTINATION DRIVE NAME (OR RETURN TO REBOOT)".

35--Type **C** and press the **RETURN** key.

After it has generated the system, SYSGEN will prompt again with "DESTINATION DRIVE NAME (OR RETURN TO REBOOT)".

36--Press the **RETURN** key.

SYSGEN will exit and the command mode prompt ("A>") will be displayed.

PIP

37--Type PIP **C:=A:*.*[R]** and press the **RETURN** key.

PIP will now transfer all of the files to the Floppy Disk that you had copied to the partition of the Winchester Disk. Again, PIP will display the name of each file when it begins to copy that file.

When PIP has finished, you will see the CP/M Command Mode prompt displayed on your monitor. You now have the original Distribution Disk, a duplicate of that disk on an 8-inch floppy disk, and the operating system is resident on a partition of the Winchester Disk. The method outlines above will not create a backup of the distribution set with BIOS set to R/O (Read Only) and to SYS (System).

Ending

40--Store the original Distribution Disk in a safe place.

41--Prepare a label for the new disk. Be certain to include the required copyright information.

Now, go on to "Section Six: Typical System Use", page 33, for a further discussion of CP/M.

Section Six: Typical System Use

To reboot your H/Z89 using the newly duplicated disk, press the **SHIFT** key on the righthand side of the keyboard (the left one won't work for this special function), and while holding it down, press the **RESET** key. Insert your system disk into the drive that you will boot and then type B followed by **RETURN** or a B then S followed by a **RETURN** if you are using the secondary device. (What this does is resets the computer system, and then tells the computer to pull the CP/M system into the computer by its own "bootstraps".

An H8 is rebooted by simultaneously pressing the "0" key and the "RST/0" key on the front panel of the computer. This will reset the system. Place the newly copied disk into the primary drive and press the number "1" key on the front panel. The system will now boot from the new disk.

Now, you should read the Digital Research manual entitled "An Introduction to CP/M Features and Facilities". This will help explain the structure and purpose of the basic commands for the CP/M operating system. Experiment with some of the commands.

> CAUTION: ERA (the command to delete files) and PIP (used to copy files) can each remove files from your disk. Use them with caution until you have fully explored their functions.

> NOTE: You can always recover from any catastrophic errors by creating another duplicate (a working backup copy) of the original Distribution Disk (or disk set if CP/M was purchased on 5.25-inch media).

Minimal System Disks:

The next step you will probably want to take is to create a disk that contains only a subset of the distribution software. This process is described in Chapter 4, but the key steps are:

1--FORMAT a disk. FORMAT is found on page 42.

2--Run MAKEBIOS if your system uses more than one disk drive controller. The instructions for MAKEBIOS are found on page 53. If you have only one type of disk controller, proceed with step 3.

3--Use MOVCPMnn to adapt CP/M to the amount of memory in your system. MOVCPMnn is described in detail on page 63.

4--Use SYSGEN to place the new system information on the blank disk. SYSGEN begins on page 66.

5--Using PIP with the "[R]" option, you should copy the disk file named "BIOS.SYS" (which is a necessity to be able to boot from the disk), as well any other files you need to create a useful "working" disk. Unlike the DUP utility, PIP may be used to transfer files to and from different types of media.

Now if you had the BIOS.SYS file on your newly created disk, it would be a good idea to set the indicators of the BIOS.SYS file as they existed originally, i.e., as R/O (Read Only) and SYS (SYSTEM) type.

6--Use STAT to set the BIOS.SYS to Read Only (R/O) and to System (SYS) by typing,

```
A>STAT C:BIOS.SYS $R/O
A>STAT C:BIOS.SYS $SYS
```

to set the appropriate indicators. Here, "C:" should be the name of the drive where the unprotected BIOS is located. Additional details are on pages 5 and 6 of the Digital Research manual, "CP/M 2.0 User's Guide For CP/M 1.4 Owners", and in "An Introduction to CP/M Features and Facilities" on page 14.

Further, if you were going to write BASIC programs, you could create a disk containing the system information, BIOS.SYS, and the files PIP.COM and STAT.COM for file manipulation. Then you could transfer the BASIC interpreter from its distribution disk (BASIC must be purchased separately) to your "working" disk. By eliminating unneeded files from this "working" disk, you gain more space on the disk for programs and data. It is often a good practice to generate a "working" disk for each project or application.

Section Seven: System Optimization

Up to and including all of the operations that you have performed so far, you have been working with a minimal system configuration. If you have more than 32 K bytes (32 times 1024 bytes) of RAM (Random Access Memory), you have not been utilizing it. In fact, CP/M thinks you only have 32K.

System Optimization is the process of determining what your system does consist of, so that CP/M may take full advantage of the resources that you have provided it with. There are basically two main programs that need to be run at this point, in order to take full advantage of your hardware.

One of these two programs is MOVCPMnn, which is covered in full detail in Chapter Four on page 63. This program lets CP/M know exactly how much memory you have. (If you have only 32K of memory then you will not need to run this program at this time.)

The other program is CONFIGUR, which you have come in brief contact with during the boot process. It is covered completely in Chapter Six on page 92. CONFIGUR will allow CP/M to know what devices you may have connected to your computer, and it will allow you to tell CP/M all of the details that it needs to know about those devices so that it may utilize them whenever you require it to do so. It also allows you to specify certain variable characteristics regarding the hardware. Among these variables are choices regarding baud rates, whether to convert output on your console device to uppercase, speed of 5.25-inch disk drives, and several other options.

CHAPTER TWO: DISTRIBUTION SOFTWARE

- **A Brief Description and List for all of the CP/M Utilities provided on the Distribution Disk(s).**
- **The Basic Instruction and Operation of ASSIGN, FORMAT, DUP, SETLP, LIST and PREL utilities.**

In addition to the standard programs that are normally included with the CP/M operating system, a number of utility programs have been included with this product to facilitate its use on your system. Below is a basic listing and brief description of all of the programs that are included in this release of CP/M. More specific instructions for each of the programs listed are included elsewhere in this manual set. Within this manual you will find all of those programs listed on the Heath/Zenith part of the list, and details regarding the two programs marked with asterisks (*) that are listed under the Digital Research portion of the list. Instructions to those two programs (SYSGEN and MOVCPMnn) are included here because they have been extensively modified to fit the Heath/Zenith requirements.

The Digital Research set includes the following programs:

ASM.COM	8080 Assembler
DDT.COM	Dynamic Debugging Tool
DUMP.ASM	Assembly Language/System Interface Example
DUMP.COM	Utility to Dump Disk Files
ED.COM	Line Oriented Text Editor
LOAD.COM	Hex to Executable-File Utility
MOVCPMnn.COM	System Relocator*
PIP.COM	Peripheral Interchange Program
STAT.COM	System and Disk Status Utility
SUBMIT.COM	Command File Executive
SYSGEN.COM	Disk System Generation Utility*
XSUB.COM	Extensions to SUBMIT to allow batched input of console responses within user programs.

---

* extensively modified for Heath/Zenith implementation.

The Heath/Zenith software is composed of:

Distribution Software	Basic Description
ASSIGN.COM	Device Assignment Utility for Winchester Disk System
BIOS.ASM	Basic Input Output System in Source Code
BRS.COM	Backup/Restore System for Winchester Disk
CONFIGUR.COM	System Configuration Utility to Optimize Hardware
DUP.COM	Disk Utility Program for Duplicating and Verifying Disk Files
FORMAT.COM	Blank Disk Formatter for Initialization
LIST.COM	Printer Driver with Optional Headings and Pagination for Disk Files
MAKEBIOS.COM	Program to Create Working BIOS
MAKEBIOS.SUB	Submit File to Create Hardware Specific Basic Input/Output System (BIOS)
PREL.COM	Page Relocatable File Utility
SETLP.COM	Utility to Change Line Printer Baud Rate

ASSIGN

ASSIGN is a utility that is only used with the Z67 Winchester Disk. The manual that was provided with the Z67 and the PART program disk should be read thoroughly before reading this section. The manual that describes the use of PART (the partitioning utility) contains much of the basic material and definitions that you must be aware of before using the ASSIGN utility.

ASSIGN is a utility that allows the user to assign logical device names to a partition. It also may be used to check what partitions are currently assigned a device name, what partitions are available to be assigned, and to remove the device assignment from any given partition.

The features provided by this utility enable the user to treat the various partitions on a Winchester disk as actual, physically separate devices. By using the device assigned to a particular partition, the user may invoke CP/M programs to interact with the partition exactly as if that partition were a separate disk drive.

In the operation of the utility that creates the partitions on the Winchester disk, the user names each partition with a designator, which may be up to sixteen characters in length. Several different partitions may possess the same names. These similarly named partitions are set apart by occurrence numbers. Each time a name is duplicated, it is assigned a different number to show that it has a distinct occurrence. (Exact details regarding the setup and treatment of partitions is contained in the documentation that came with the Winchester disk. Please refer to that document for more detailed information.)

For example, consider a Winchester disk that has been partitioned into three distinct partitions that are to utilize CP/M in their manipulation. Desiring to remember which operating system created these files, the user has decided to name all three as "CPM". The first CPM, partition-name occurrence would be "CPM;0", where the semicolon (;) is used to separate the partition name from the partition-name's occurrence. The second partition named as CPM, would be CPM;1 (occurrence number 2), the third partition, CPM;2 (occurrence 3).

The four operations performed by the ASSIGN utility all begin with typing in **ASSIGN** and then are followed by distinct operators that determine what ASSIGN is to do.

Assignments Available:

To see what assignments are possible, the user would type:

```
A>ASSIGN ?
```

The computer might respond with

```
                                           MAXIMUM
        PARTITION NAME            OCCURRENCE NUMBER
        -------------------------------------------
                CPM                       2
```

which shows that the user set boundaries with PART (the Partitioning Utility) for three seperate partitions--CPM;0, CPM;1, and CPM;2.

> NOTE: This is only an example of the display that a user receives. The "Partition Names" that show on the display would be those names that were Assigned by the user during PART's operation. If multiple partitions were not named with the same name, then the maximum occurrence number for each partition name would be 0 (zero). If the same name were used for two different partitions, 1 (one) would be the maximum occurrence number. If the name were used on three partitions (as was the case for this example), then 2 (two) is the maximum occurrence number. The first occurrence of a name is always 0 (zero), the second occurrence is 1 (one), the third is 2 (two), the fourth is 3 (three), and so on.

Make Assignment:

To make an assignment, the user would request:

```
A>ASSIGN X:=partition-name[;n]
```

Where "X:" is the device name, "partition-name" is a name given for a currently resident partition, and ";n" is the optional occurrence number of that partition name.

> NOTE: The occurrence number of any given partition must be preceded by a semicolon (;). If no occurrence number is specified, occurrence number 0 is assumed.

An example of this might be:

```
A>ASSIGN A:=CPM                RETURN
A>ASSIGN B:=CPM;1              RETURN
```

This example assumes that the floppy drive in the Winchester System was the boot device and that at least two partitions exist that are called "CPM".

Assignments Made:

To see what assignments have been made, the user types,

```
A>ASSIGN        (then presses RETURN)
```

to the CP/M command mode prompt. During a terminal session, if we still consider the example that was given above, ASSIGN might respond with:

```
A: = CPM
B: = CPM;1
```

Remove Assignment:

To remove a previously made assignment, the user would type:

```
A>ASSIGN X:
```

Here again, "X:" is the device name. When "ASSIGN" is typed, followed by a device name, with no other operator, ASSIGN essentially assigns that device name to "nothing". It finds no partition name with which it is to make the assignment so it then assigns the given device name to no partition.

Restrictions:

ASSIGN has been restricted so that no more than two device assignments can be made at any given time to partitions on the Winchester Disk System.

The possible assignments that may be made with ASSIGN are also restricted. Drive A: is always the device (the Winchester disk drive or the floppy disk drive) that the cold boot was performed on. If the cold boot was performed on the 8-inch floppy in the Z67 system, then B: and C: may be assigned to partitions on the Winchester Disk. If the cold boot was performed on the Winchester Disk, A: is the partition that was booted and C: is the 8-inch floppy device. B: may be assigned to a second partition if one exists.

NOTE: The PART utility only defines a partition's boundaries and does not format the partition. A partition must be formatted to enable it to store data. If the partition is not used as the boot device (where it is automatically assigned with the logical device name of "A:"), it will need to be assigned so that CP/M can locate that partition. Then the FORMAT program needs to be run to ready the partition. Once a partition has been formatted it is not necessary to reformat it on any subsequent uses. If the partition is reformatted, any files on that partition will be erased.

FORMAT

The FORMAT program allows you to initialize blank disks (or partitions) or to reinitialize used disks (or partitions) that contain information that you no longer need. This utility also performs a check on the disk media to detect imperfections on the recording surface.

> CAUTION: Before using the FORMAT utility, be certain that the disk that you plan to format does not contain any needed information. FORMAT will erase all of the tracks, including any files, that are on the disk, effectively destroying those files.

The disk must be "formatted" before it can be used for data storage with your H/Z89 or H8. The FORMAT utility writes the necessary information on the disk to permit the computer to find specific "tracks" and "sectors" where data are stored. In the process, it erases any information that may have been previously recorded on the disk. This erasure permits you to reuse disks.

An 8-inch disk or a soft-sectored disk used with the Z37 may be formatted in several ways depending on the number of sides of the disk to be used and the density at which the data is to recorded. Density refers to how close together the data is recorded on the disk. Single density is the normal spacing of the data bits on the disk. Double density refers to the fact that the data bits are almost twice as close together so that nearly twice as much information can be recorded on a disk. This requires a better quality disk which is certified to be capable of double density recording. Extended density allows the user to store a maximum amount of data on the disk. Some disks are capable of storing data on both sides of the media. If an 8-inch, double-sided disk is placed in the drive, both sides will automatically be used. FORMAT will prompt for both density and number of sides on a 5.25-inch soft-sectored disk.

To use the FORMAT program, type **FORMAT** in response to the CP/M prompt. The utility will identify itself and ask if you are certain that this is the program you wish to run. It will then ask for the drive you wish to use to format a disk.

Select one of your disk drives by responding with a letter from "A:" to "F:" ("A:" through "E:" with the H8). Be sure to select a device name that actually exits in your system. Put the desired disk in the selected drive, making certain to orient it properly, and that the disk is not write-protected (see Appendix E).

Type **X**, where "X" is the device name that you have selected, and press **RETURN** to start the formatting operation. When this operation is complete, you will be given the option to either format additional disks, or return to the CP/M command mode. When FORMAT is done reinsert the original CP/M disk (if it was removed), and press **RETURN**.

The system will return to the CP/M prompt ("X>", where "X:" is the logged drive).

The following example illustrates the procedure:

NOTE: To format a 96 TPI disk in a Z37, CONFIGUR must first be set to 96TPI for the drive that will be used. See: "Disk Parameters Sub-Menu" in Chapter Six on page 102 for more details.

Stepwise Procedure:

1--Type **FORMAT** in response to CP/M command mode prompt.

```
A>FORMAT

Format Version 2.nn
This program is used to initialize a disk.
All information currently on the disk will be destroyed.
```

2--FORMAT asks "Is that what you want (y/n):".

```
Is that what you want? (y/n):
```

3--If there is nothing on the disk that you want, and you wish to proceed, type **Y**.

```
Is that what you want? (y/n): Y
```

4--FORMAT asks "Which drive do you wish to use for this operation?:".

```
Which drive do you wish to use for this operation?:
```

5--Respond with the letter name of the drive that contains the disk that you want to format.

```
Which drive do you wish to use for this operation?:B
```

6--If your response in step 5 is the letter name of a hard-sectored, 5-inch drive, ignore steps 7, 8, 9 and 10; then go on to step 11.

7--If your response in step 5 is an 8-inch disk drive, FORMAT asks "Which Density? (S=single, D=double, E=Extended):".

```
Which density? (S=single, D=double, E=extended):E
```

8--Or if your response in step 5 was a soft-sectored, 5.25-inch disk drive or the 8-inch floppy drive that accompanies the Winchester disk system, FORMAT will ask "Which Density? (S=single, D=double):".

```
Which density?  (S=single, D=double):D
```

9--If FORMAT asked you for a response to the questions in step 7 or step 8, type the letter that designates the density that you intend to use.

10--If the drive that was selected is a Z37, FORMAT will enquire whether the disk being used is to be single or double sided.

```
Number of Sides? (1=single, 2=double):1
```

11--FORMAT will then request that you "Put the disk you wish to be formatted in drive X." The "X" in this question will appear as the drive designation that you answered in step 5.

```
Put the disk you wish to be formatted in drive B.
```

12--Insert the disk that you are going to format into the drive that you specified in step 5.

13--At the same time as step 11, FORMAT will also request you to "Press RETURN to begin."

```
Put the disk you wish to be formatted in drive B.
Press RETURN to begin. RETURN
```

14--Press **RETURN**.

15--No prompt will appear and the drive's active light will stay on throughout the operation. FORMAT is formatting.

16--FORMAT will then ask "Do you have more disks to format? (y/n):"

```
Do you have more disks to format? (y/n):
```

17--If you want to format additional disks type y. FORMAT will go to step 4 and repeat the process. If you have no additional disks to format, type n.

```
Do you have more disks to format? (y/n):N
```

18--FORMAT will then request that you "Place a bootable disk in drive A and press any character:".

```
Place a bootable disk in drive A and press any character:
```

19--Press **RETURN** in response to the request:

Place a bootable disk in drive A and press any character:**RETURN**

20--The CP/M command mode prompt will reappear. FORMAT is done.

A>

9--If FORMAT asks you for a response to the questions in step 7 or step 8, type the letter that designates the density that you intend to use.

10--If the drive that was selected is a [illegible], FORMAT will enquire whether the disk being used is to be single or double sided:

Number of Sides? (1=single, 2=double):

11--FORMAT will then request that you [illegible]

12--[illegible]

DUP

DUP, the Heath/Zenith Disk Utility Program, provides a convenient way to duplicate a disk or to verify that two disks are identical. To use it, your system must have two or more 5.25-inch disk drives or two 8-inch drives.

> NOTE: The DUP utility will only transfer files between identical media. CP/M's utility PIP (Peripheral Interchange Program) should be used in any instance when files need to be transferred between different media, e.g., from hard-sectored to soft-sectored 5.25-inch disks.

After the system has been "booted", you can use the DUP utility to duplicate the entire contents of a disk onto another disk. The two disks must be the same size and density. An example of this program is as follows:

```
A>DUP

Disk Utility Program
Version 2.nn
```

You may at this point elect to "copy and verify" a disk, to simply "copy" a disk without verification, or just "verify" that two disks are identical. When done, you may exit to the operating system by selecting the "Z" option.

> NOTE: In copying a disk, the destination disk must be formatted if it is an 8-inch or a 5.25-inch, soft-sectored disk. A 5.25-inch hard-sectored disk does not have to be formatted before the DUP operation.

> CAUTION: The destination disk should not contain any useful information since in the process of duplication all information previously on it will be erased.

Continuing with the sample, select the "A" option to "copy and verify":

```
Source unit: A           (drive name of disk to be copied)
Destination unit: B      (drive name of blank disk)

Put source disk in drive A.
Put destination disk in drive B.

Press RETURN to begin: RETURN  (Press RETURN after insertion)
                (Copy operation proceeds)
Copy finished.
                (Verify operation proceeds)
Verification Finished.
```

> NOTE: the source and destination drives for this operation must be different physical drives of the same size and density.

When the source and destination disks have been properly inserted in their respective drives, press **RETURN** to initiate the copying process. If you should decide to abort the copy operation, type any character other than a **RETURN**. If you opted to do a "copy and verify" operation, the "verify" will begin automatically after "copy" is completed. When done, be certain to label the destination disk, and remember to affix the required copyright notice to the new disk if it contains copyrighted Digital Research or Heath/Zenith software.

The "verify" operation is useful in comparing a copy of a disk made by DUP. The "verify" operation will only check to see if the two disks contain identical copies of the same information located in the same positions (sectors) on a disk. Since "verify" does not utilize or understand the CP/M file system, it is conceivable that two disks could contain the same files, but perhaps in a different order (i.e., on different sectors), which would cause "verify" to report that they were different disks.

When the selected operation is completed, the DUP utility will again prompt for a selection:

```
        Do you want to:

                     A  copy and verify
                     B  copy only
                     C  verify only

                     Z  exit to operating system

        Selection:
```

Repeat the operation or type Z to exit back to the CP/M command mode prompt.

SETLP

The SETLP utility provides the user with the ability to dynamically change the lineprinter port, baud rate. The baud rate is set initially at cold boot time to the value indicated by CONFIGUR. This program is included to permit the user to alternate between printers that are set at different baud rates, without reCONFIGURing--such as when switching back and forth between a Diablo and an H14 or WH24. SETLP temporarily alters the values kept in memory but it does not affect the baud rate information stored on the disk.

SETLP requires one argument, the new baud rate, which can be any of the following:

75
110
134.5
150
300
600
1200
2400
4800
9600
19200
38400

Example:

```
A>SETLP 1200        RETURN
A>
```

This command sets the line printer port baud rate to 1200.

In the usual Heath/Zenith hardware configuration the Diablo letter quality printers (WH44, etc.) are set to 1200 baud, and the dot matrix printers (H/Z25, etc.) are set to 4800 baud. The H36 and the WH34 are generally set to 300 baud. For all other printers, refer to the manual which accompanies that printer.

LIST

The LIST command is used to list one or more text files on the printer connected to the system. Typically, the files that you will list are the "*.PRN" files generated by the assembler, BASIC programs, or simply readable text files produced by the editor. LIST also provides a number of optional functions, including pagination, headings, and tab expansion.

The form of this command is similar to that of PIP. The LIST command can either be entered in response to the system prompt "X>" either with or without arguments. In the latter case, the LIST utility then prompts for the arguments with an "*".

The command format that is used with this utility are:

```
     A>LIST file1 { file2 { file3...}} {parameters}
or
     A>_LIST     RETURN
     * file1 { file2 { file3...}} {parameters}
```

The arguments enclosed in "{}" are optional, note however, that spaces are required to separate individual files. The program may be terminated by either pressing **RETURN** or by simultaneously holding down the CTRL (Control) key and the ^C (letter "C"), as a response after the prompt "*" appears (when used in the prompt mode).

The available parameters are:

[D xxxxxxxxxx]	represents up to ten characters in a field that may be designated as a date field that will be printed directly to the left of the page number. If this option is not selected, it defaults to blanks.
[H text]	represents up to sixty characters in a field that may be used as a header, which prints on the top line of each page. If this option is not selected, the program defaults to the name of the file that is being listed (e.g., LIST.COM).
[L nn]	sets number of lines of user text per page, default=60. L=0 turns off pagination.
[N]	no heading line (which implies no page numbering).
[T nn]	tab stops every nn positions, default = 8.
[P nn]	start page numbers with nn, default=1.
[U]	force all output to upper case.

[C nn]	number of copies of output created by this command line, default = 1.
[E]	erases files on that command line after listing them.

When used in the prompt mode, all selected parameters (with the exceptions of starting page number and the erasure of files after listing) remain in effect until the program is exited.

> NOTE: when used from the command line, the CCP (Console Command Processor) will force the mapping of all heading and date information to upper case. (Refer to the Digital Research Documentation for further details on forced upper case by the CCP.)

Output from LIST can be aborted by typing any character on the console keyboard during printing.

Sample Printout of the LIST Utility:

```
     A>LIST MEMBERS.LST [H MEMBERSHIP LIST] [D 6/30/80]
or
     A>LIST RETURN
     *MEMBER.LST [H MEMBERSHIP LIST] [D 6/30/80]
```

might produce the following:

```
MEMBERSHIP LIST                     6/30/80 PAGE 1

      Jones, William       1001 Oak Street
                           Busytown, MI
                           02987

      Mauldin, Shirley     3344 Maple Road
                           Whoknows, ID
                           26783

      Smith, John          276 Elmwood Drive
                           Anywhere, IL.
                           60988
```

PREL

The Heath/Zenith supplied program PREL will take the hex output files of two assemblies and generate a relocatable file. The first of the assemblies should have as an origin 000H and the second assembly should be one page higher, or 0100H. The hex output of the first assembly should have an extension of HX0, and the hex output of the second should have HX1 for its extension.

PREL requires two arguments: the first is the primary name of the two hex files and the second is the primary name of the output page relocatable file. The output file will have the extension PRE. For example the command line:

```
A>PREL MYPROG TESTPROG
```

would create the file TESTPROG.PRE from the two hex files MYPROG.HX0 and MYPROG.HX1.

PREL will compare the two hex files and perform two separate functions. The first of these is to convert the hex file to a binary file similar to the function of the LOAD transient. In addition it appends a relocation table to the end of the file which includes a bit for each byte in the module. If a particular bit is a one, it means that the value of the associated byte must be relocated when the program is loaded into memory. An error message will result if the hex values for a given byte differ by other than 0 or 1. An error message will also result if the addresses in the hex files are not in numerical order.

All addresses that need to be relocated should be expressed relative to the base of the module and not defined absolutely. A convenient way to do this is to not put any "org" statements in your program and then use batched commands in a Submit file that actually does the required assemblies and the conversion to a relocatable format. An example of this type of batched command might be:

```
PIP TEMP0.ASM=ORG0.ASM,$1.ASM
ASM TEMP0.AAZ
REN $1.HX0=TEMP0.HEX
ERA TEMP0.ASM
PIP TEMP1.ASM=ORG1.ASM,$1.ASM
ASM TEMP1.AAZ
ERA TEMP1.ASM
REN $1.HX1=TEMP1.HEX
PREL $1 $1
ERA $1.HX0
ERA $1.HX1
```

where the files ORG0.ASM and ORG1.ASM contain only the statements "org 0000H" and "org 0100H" respectively.

You could invoke this command sequence by typing:

```
SUBMIT MAKEPRE MYPROG
```

where the above command sequence is contained in a file called MAKEPRE.SUB, the original assembly file is called MYPROG.ASM and the final result is a page relocatable file called MYPROG.PRE.

> NOTE: This type of program relocation occurs during the MAKEBIOS utility operation. During MAKEBIOS operation, the relocation commands for the two offset files appear on the terminal.

CHAPTER THREE: MAKEBIOS UTILITY OPERATION

- **The Basic Description of MAKEBIOS Functions.**
- **Precautionary Notes for the Use of MAKEBIOS.**
- **The Basic Operation to Create a New BIOS.**
- **How to Implement the Newly Created BIOS.**

The CP/M Basic Input/Output System (BIOS) must provide routines for the Input/Output operations for any peripheral devices that are connected to the Heath/Zenith Computer. Among these devices may be the disk drives, keyboard, a video terminal and a printer.

Because Heath/Zenith computers may be configured to use a large variety and combination of different types of disk drives, extensive modifications to the original Digital Research BIOS were necessary to operate efficiently with each type and combination. MAKEBIOS is the utility program that allows the user the ability to customize a system with the drives that may best handle a user's particular needs. The Distribution Disk (or Disk-Set) that you have purchased comes with a minimally configured BIOS that handles a basic system, appropriate for the type of media on which it was supplied. If at any time you decide to add disk drives to your system, MAKEBIOS is essential to build a BIOS that will allow the use of the drives that you might choose.

A single BIOS that could handle everyone's needs would not be memory effective, the BIOS would be too large and would require a large amount of memory for a minimum system. MAKEBIOS is a batch program that is submitted using the Submit command. MAKEBIOS relies heavily on some of the basic functions of the CP/M operating system, and some special programs designed by Heath/Zenith's software engineers.

Section One: Precautionary Notes:

MAKEBIOS is a self-modifying program that requests the specific disk system combinations that are being used in the system, and then appends the necessary routines to itself while dropping all of the unnecessary routines. Because of the very complex nature of the program and because it is self-modifying, the user needs to observe three cautions faithfully!

CAUTION ONE:

Before running MAKEBIOS, make a backup copy of the complete distribution disk and keep the original in a very safe place. Always use the backup copy in any operations.

CAUTION TWO:

MAKEBIOS modifies the source program BIOS.ASM, located on the Distribution Disk. The source code consists of a main body and a preamble. Changing the order of the preamble portion of the program or its initial values can easily render that source program totally useless, which is another reason that backup copies of disks are essential.

Because the program is self-modifying, it expects certain values to be in precise places. If the arrangement of the code is altered, or if any of the values have been changed, MAKEBIOS will not know that the changes have been made but it will alter the program anyway.

CAUTION THREE:

Some care needs to be taken during a transfer of the MAKEBIOS program (and the associated programs that MAKEBIOS uses) to other disks. MAKEBIOS calls other programs from disk, and if a particular program is not present on the correct disk, MAKEBIOS may execute incorrectly or cause the system to run endlessly, making it necessary to reboot. This could waste valuable time, and cause frustration because the program would have to run again with all of the programs resident on the correct disk. The user should not attempt to copy MAKEBIOS to another disk unless the user copies all of the associated files to that new disk.

Section Two: Operation of MAKEBIOS

To begin operation of the MAKEBIOS program, type in **SUBMIT MAKEBIOS**, followed by the drive name where you want to store the new BIOS (details on Submit may be found in the Digital Research Manuals). The format of the command would be:

```
A>SUBMIT  {Y:}MAKEBIOS  {X:{Filename}}  {Y:}
```

Here, the "X:" is the optional destination drive name, where the new BIOS is to be sent when completed. If no drive is specified, the currently logged drive is assumed (in the case above "A" is the logged drive and is shown by the prompt "A>").

> NOTE: The SUBMIT program must be located on the disk in drive A.

"Filename" is an optional name given to the new BIOS so that it does not overwrite a previously existing BIOS that might already be resident on the destination drive. This type of overwrite could be catastrophic if the destination were specified as the drive where the only copy of the original BIOS is located.

The "Y:" is the optional source drive name for the BIOS (and where MAKEBIOS.SUB must be resident) that is to be used for this operation.

> NOTE: At least one space must be inserted between each of the parameters typed on the command line.

> NOTE: If your Distribution Disk Set is on 5.25-inch media, MAKEBIOS should be run with VOL. I in A:, VOL. III in B: and the destination disk for the new BIOS in C:. Then use the following command:

```
A>SUBMIT B:MAKEBIOS C: B:
```

An example of the display that occurs during a full operation of the MAKEBIOS utility would be as follows:

```
                                          (Here, the "C:"
                                          specifies the
     A>SUBMIT MAKEBIOS C:        RETURN   name of the drive
                                          the new BIOS is
     A>MAKEBIOS 1 C:                      to be sent to.)

          BIOS SELECTION MENU

     A -- H17 ONLY
     B -- H37 ONLY
     C -- H47 ONLY
     D -- H67 ONLY
     E -- H17 AND H37
     F -- H17 AND H47
     G -- H17 AND H67
     H -- H37 AND H47
     I -- H37 AND H67
     J -- H47 AND H67
                                   (Here the program
     ENTER SELECTION: I            will pause until
                                   the user responds.)
     A>ASM BIOS.AAZ
     CP/M ASSEMBLER - VER 2.0         (Long delay, while
     1543                             working.)
     051H USE FACTOR
     END OF ASSEMBLY

     A>REN BIOS.HX0=BIOS.HEX
     A>MAKEBIOS 2 C:

     A>ASM BIOS.AAZ
     CP/M ASSEMBLER - VER 2.0         (Long delay, while
     1643                             working.)
     051H USE FACTOR
     END OF ASSEMBLY

     A>REN BIOS.HX1=BIOS.HEX
     A>PREL BIOS C:

     A>MAKEBIOS 3 C:

     MAKEBIOS FUNCTION COMPLETE
```

The MAKEBIOS program has completed the new BIOS.

The new BIOS may be transported via PIP (with the "[R]" option if the BIOS has been set as $SYS and $R/O with STAT) to other disks if desired. If these two options are set, typing

```
A>STAT {X:}BIOS.SYS            RETURN
```

where "X:" is the drive where the BIOS.SYS file is located, will display

```
 RECS  BYTES  EXT ACC
   42     6K    1 R/O A:(BIOS.SYS)
BYTES REMAINING ON A: nnK
```

The "R/O" signifies that the file is set to Read/Only status, and the parentheses around the filename, (BIOS.SYS), indicate that the file is set to $SYS (System File).

As an example of a R/O and SYS file transfer, use PIP like this:

```
A>PIP B:=C:BIOS.SYS[R]
```

This example assumes that you are logged on drive "A:" (A>) and that PIP.COM was on the disk in that drive. It also assumes that the BIOS.SYS location is on drive "C:" and that you are copying it to drive "B:".

After the new BIOS is on the disk that you wanted to transfer it to, use STAT to set the BIOS.SYS to Read Only (R/O) and to System (SYS) by typing,

```
A>STAT B:BIOS.SYS $R/O
A>STAT B:BIOS.SYS $SYS
```

to set the appropriate indicators. Here, "B:" should be the name of the drive where the unprotected BIOS is located. Additional details are on pages 5 and 6 of the Digital Research manual, "CP/M 2.0 User's Guide For CP/M 1.4 Owners", and in "An Introduction to CP/M Features and Facilities" on page 14.

Section Three: Implementing the New BIOS

There are several steps that must be performed after the new BIOS has been created with MAKEBIOS to utilize that new BIOS. The basic outline of these steps would be:

- Create a new BIOS with MAKEBIOS.
- Use MOVCPMnn to properly configure the operating system with the newly created BIOS and memory size for the hardware where it will run.
- Place the newly configured operating system on the system tracks of the disk to be used with SYSGEN.
- Put a copy of the newly created BIOS.SYS on the disk if it is to be a bootable disk.

NOTE: After a new BIOS has been created with MAKEBIOS, it is extremely important to name the BIOS descriptor when MOVCPMnn is used. The new BIOS is not resident in memory after MAKEBIOS is run. The new BIOS is located where MAKEBIOS was requested to place it (or on the disk in Drive A: if no destination drive was specified). The new BIOS must also be renamed to "BIOS.SYS" if the MAKEBIOS option was used to create the BIOS under an optional filename.

An example of the total operation for BIOS generation and implementation, including MAKEBIOS, MOVCPMnn and SYSGEN is shown below. This example might be performed on the following hardware configuration:

- A H/Z89 or an H8 Computer
- 64K of RAM (Random Access Memory)
- One H/Z47
- One H/Z17

```
A>SUBMIT MAKEBIOS B:NEWBIOS   RETURN   (Command input by
                                        user. Submit and
                                        MAKEBIOS are
                                        located on drive
                                        "A:". The new
                                        BIOS, "NEWBIOS", is
                                        to be sent to drive
                                        "B:".)

A>MAKEBIOS 1 B:NEWBIOS        (Phase One of MAKEBIOS begins)
```

```
     BIOS SELECTION MENU

A -- H17 ONLY
B -- H37 ONLY
C -- H47 ONLY
D -- H67 ONLY
E -- H17 AND H37
F -- H17 AND H47
G -- H17 AND H67
H -- H37 AND H47
I -- H37 AND H67
J -- H47 AND H67

ENTER SELECTION: F          (User  chooses a BIOS for  the
                            H/Z17 and H/Z47 disk drives.)

A>ASM BIOS.AAZ              (Page  Zero  Assembly  begins)
CP/M ASSEMBLER - VER 2.0
1560
02EH USE FACTOR
END OF ASSEMBLY

A>REN BIOS.HX0=BIOS.HEX     (Hex File renamed HX0.)
A>MAKEBIOS 2 B:NEWBIOS      (Phase Two begins.)

A>ASM BIOS.AAZ              (Page  One Assembly begins.)
CP/M ASSEMBLER - VER 2.0
1660
02EH USE FACTOR
END OF ASSEMBLY

A>REN BIOS.HX1=BIOS.HEX     (Second Hex File renamed to HX1.)
A>PREL BIOS B:NEWBIOS       (PREL  locates BIOS  with  HX0
                            and HX1 extensions, and builds
                            a   relocation  table  of  the
                            addresses.)

A>MAKEBIOS 3 B:NEWBIOS      (Phase Three begins.)

MAKEBIOS FUNCTION COMPLETE  (NEWBIOS  is now  resident  on
                            drive "B:".)

A>MOVCPM47 64 B:NEWBIOS     (Make  system for H/Z47  disk,
                            configured for 64K RAM,  using
                            the  BIOS called "NEWBIOS"  on
                            drive B:".)

MOVCPM47 VER 2.2.03         (MOVCPM47 begins.)

CONSTRUCTING 64K CP/M vers 2.2   (States size requested.)
READY FOR "SYSGEN" OR            (The  new  System is ready
"SAVE 38 CPM64.COM"              in memory.)
```

```
A>SYSGEN                      (User calls system generator.)

SYSGEN VER 2.2.03             (SYSGEN begins.)

SOURCE DRIVE NAME (OR RETURN TO  SKIP):    RETURN   (User
                              presses  RETURN because MOVCPM
                              placed the newly sized  system
                              in memory.)

DESTINATION DRIVE NAME (OR RETURN TO REBOOT):B       (User
                              requests  that the new  system
                              be   written  to  the   system
                              tracks of the disk in the "B:"
                              drive.)

DESTINATION ON B, THEN TYPE RETURN         RETURN    (Yes,
                              "B:" is the destination drive.
                              User presses RETURN.)

FUNCTION COMPLETE             (New   system  is  written  to
                              system tracks of disk in drive
                              "B:".)
DESTINATION DRIVE NAME (OR RETURN TO REBOOT):RETURN  (User
                              may  want to continue here  by
                              inserting   another  formatted
                              H/Z47  disk into a  drive  and
                              typing in an appropriate drive
                              name.   In  the  example,  the
                              user  only makes one  bootable
                              disk.)

A>REN B:BIOS.SYS=B:NEWBIOS    (New BIOS is named to BIOS.SYS
                              so  that  the BIOS Loader  can
                              locate the file.)
A>STAT B:BIOS.SYS $R/O        (BIOS.SYS  is  set  for   Read
                              Only.)

A>STAT B:BIOS.SYS $SYS        (BIOS.SYS  is  set  as  System
                              File.)
A>                            (CP/M awaits next command.)
```

CHAPTER FOUR: USING MOVCPM AND SYSGEN

- The Basic Description of MOVCPMnn and SYSGEN.
- The Operation of SYSGEN.
- How to Operate MOVCPMnn and the Options that are Available.

The FORMAT utility prepares a disk so that it may be used to store recorded data but it does not enable the disk to be booted. FORMAT creates a magnetic map on the disks surface so that the operating system is able to distinguish different locations on the disk where data may be stored. These locations are called tracks and sectors. Tracks are closely spaced magnetic rings that run parallel to the outer edge of the disk; they are much like the grooves in a record but they form a complete circle and not a spiral. Sectors are magnetic subdivisions of tracks.

SYSGEN, the system generating utility, writes the disk operating system to specifically allocated tracks on the disk. These allocated tracks are the "System Tracks" and are located along the outer circumference of the disk's recording surface. The disk operating system contains the additional routines that are required by the monitor ROM so that on a boot, the operating system can place the necessary operating system routines and BIOS (provided that it is also located on the disk) where they can perform all of the necessary functions in memory. (Chapter Seven on page108 contains additional details about the interaction between the system tracks and BIOS).

MOVCPM is a utility that adjusts the operating system to use different memory sizes. This release of CP/M is initially configured for a 32K memory. Using MOVCPM will create an image of the operating system that may utilize the full amount of memory which is available in the system. When MOVCPM has completed its operations, it has stored an image of the operating system in memory at a location known to the operating system. It is from this known location in memory that SYSGEN copies the system image and writes it to the system tracks on the disk.

NOTE: When MOVCPMnn is to be performed with a BIOS created by the MAKEBIOS utility, both {memory size} and {BIOS descriptor} must be specified. This is because a BIOS created by MAKEBIOS is not in memory and MOVCPMnn needs to be told which disk drive contains the new BIOS.

Section One: MOVCPMnn

There are four MOVCPM programs and each of them allows the user to reconfigure the CP/M system to a particular memory size for a particular type of disk drive. The Heath/Zenith implementation of CP/M will run in as little as 32K or as much as 64K. The different versions of the program operate identically, with MOVCPMnn used to size the operating system to match the required memory and make bootable disks, where "nn" is the type of disk controller that will read the disk when booted.

Boot-Device controller designation: nn

MOVCPM17	for the H/Z17 controller	(5.25-inch hard-sectored)
MOVCPM37	for the Z37 controller	(5.25-inch soft-sectored)
MOVCPM47	for the H/Z47 controller	(8-inch floppy)
MOVCPM67	for the Z67 controller	(Winchester Disk System)

The basic command format is:

```
MOVCPMnn {memory size} {BIOS descriptor}
```

MOVCPMnn permits two optional parameters (designated here by those fields enclosed between the left and right braces, "{}"). One parameter, "{memory size}", sets the size of the desired system in multiples of 1024 (K) bytes. The second parameter, "{BIOS descriptor}", specifies the location of the BIOS that is to be used for the operation. If no parameters are given, MOVCPMnn will automatically configure the system for the maximum memory size found by a hardware exploration of the machine and use the BIOS that is currently resident in memory. If the "BIOS descriptor" parameter is omitted, CP/M will use the BIOS that is currently loaded in memory.

> NOTE: After a new BIOS has been created with MAKEBIOS, it is extremely important to name the BIOS descriptor when MOVCPMnn is used. The new BIOS is not placed in memory after MAKEBIOS is run. The new BIOS is located where MAKEBIOS was requested to place it. The new BIOS must also be renamed to "BIOS.SYS" if the MAKEBIOS option was used to create the BIOS under a filename other than "BIOS.SYS".

The options that are available for each of the two parameters are as follows:

Syntax: MOVCPMnn {memory size} {BIOS descriptor}

Memory Size (optional): {memory size}

xx =an integer expressing the size in kilobytes (multiples of 1024)

* =a hardware exploration is performed and uses the total quantity of memory it finds connected and available.

null =if no specification is made (null), MOVCPMnn treats it as it would an asterisk (*).

> NOTE: If the {BIOS descriptor} parameter is specified, MOVCPMnn requires that an asterisk (*) or an integer (nn) parameter is specified.

BIOS descriptor (optional): {BIOS descriptor}

* =uses BIOS currently resident in memory.

null =if no specification is made, MOVCPMnn uses the current BIOS in memory.

X: =MOVCPMnn will use the BIOS.SYS found on drive designated by "X".

X:filename =MOVCPMnn uses "filename" on drive "X" as the BIOS source.

> NOTE: If the {BIOS descriptor} parameter is specified, MOVCPMnn requires that a {memory size} parameter is also specified.

Some examples of MOVCPMnn are:

A>MOVCPM67 64 *	(bootable from Z67 controlled drive, for 64K using the BIOS currently in memory).
A>MOVCPM37 * C:	(bootable from a Z37 controlled drive, for the amount of memory found in a hardware exploration, using the file C:BIOS.SYS).
A>MOVCPM17 32 B:MYBIOS	(bootable from H/Z17 controlled drive, for 32K memory, using a file called "MYBIOS", an optionally named BIOS created with MAKEBIOS, as the BIOS).

NOTE: MOVCPMnn may be used to configure a disk for less memory than is actually present in the system but if the disk is set for more than is currently in the system, you will not be able to boot the disk.

Memory size (optional) = memory size

nn = an integer expressing the size in kilobytes (mult of 1024

* = a hardware exploration is performed and uses the quantity of memory it finds connected and availabl

null = if no specification is made (null), MOVCPMnn treats as it would an asterisk (*).

NOTE: If the (BIOS descriptor) parameter is specified, MOVCPMnn requires that an asterisk (*) or an integer (nn) parameter is specified.

BIOS descriptor (optional) = (BIOS descriptor)

* = uses BIOS currently resident in memory

null = if no specification is made [illegible] current BIOS in memory

Section Two: SYSGEN

SYSGEN permits the user to place the portion of the operating system that pertains specifically to the disk operations on the system tracks of a disk. It will also permit COPYING a system from the system tracks of one disk to the system tracks of another disk. When used to put a system created by MOVCPMnn onto the system tracks of a disk, run the SYSGEN program as follows:

```
A>SYSGEN
SYSGEN VER 2.2.03
SOURCE DRIVE NAME (OR RETURN TO SKIP)
```

When asked for the SOURCE DRIVE, press **RETURN**. No source is necessary in this particular case because MOVCPMnn left the system at a pre-determined location in memory, and a **RETURN** causes the program to use what it finds at that particular memory location as the source from which it is to generate a system. (See: "MOVCPMnn" for further details.)

SYSGEN will then prompt with,

```
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)
```

Place the desired destination disk in a drive, type the letter indicating that drive, and then press **RETURN**. SYSGEN will complete the write operation and again prompt for a Destination Drive. If you wish to put the system on additional disks, you may repeatedly select destination disks. If you do not want to SYSGEN additional disks, press **RETURN** to the above prompt.

If the system that you wish to copy is on a disk (as opposed to being in memory) you will need to read the system in from that disk. The procedures are the same except that you answer the prompt,

```
SOURCE DRIVE NAME (OR RETURN TO SKIP)
```

with a valid drive name. The system will then be read into memory at the sysgen location. After the system is read from the disk, sysgen will offer you the option of automatically copying BIOS.SYS from source disk to the destination. The prompt

```
COPY BIOS.SYS (Y/N):
```

is displayed at the terminal. If you type "Y", BIOS.SYS will be copied from the source disk. If BIOS.SYS is not present on the disk, an error message will be displayed and SYSGEN will continue. If your response to the prompt is "N", the automatic copying of BIOS.SYS is skipped. Writing the system to destination disks follows the same procedures given above.

You will find it worthwhile to examine the interaction of the MAKEBIOS, MOVCPMnn, SYSGEN, Save, and DDT utilities. For more information see the "CP/M 2.0 ALTERATION GUIDE"

CHAPTER FIVE: THE BACKUP/RESTORE SYSTEM

- **Beginning the Backup/Restore Program**
- **Operation from the Main Menu and Primary Options**
  - **How to Change the Logged Date**
  - **Creation of Backup Files and Secondary Options**
  - **The Restoration of Files**
- **Comparing Two Identical Files for Accuracy**
- **Listing the Directory of a Backup Disk or Disk Set**

The Backup and Restore program is designed only for use with the Z67 Winchester Disk System. (If you do not have a Z67 Winchester Disk System, skip over this Chapter and read Chapter Six.) This program allows the user to create backup copies of any Winchester disk files by putting those files onto floppy disks. It also allows the backup copies to be written back onto the Winchester disk.

The operations of Backup and of Restore are methods for transferring files. The names of these two operations describe the direction in which the file transfer takes place. Backup transfers the files from Winchester disk onto floppy disk. Restore transfers them from the floppy backup medium to the Winchester disk.

This program is ultimately limited to an 8 Megabyte file size (the maximum CP/M supportable size for the Winchester disk), and it may be used with either random or sequential files. Each backup disk that is created will contain both a volume number and a date of creation written to the disks as filenames, even though they contain no file. This distinguishes one backup disk from another.

This utility is able to work with files that are larger than the medium where they are to be stored because it provides a method of storage that allows a file to exist laterally over several floppy disks. This method creates a separate directory that is located on the first disk that is created during each backup operation. This directory provides the means for this program to handle files that extend across several disks. The directory keeps track of which volume number(s) a file has been stored on.

Section One: Beginning Operation

Invoking the Program:

On the system disk the file for the Backup and Restore program is listed on the directory as BRS.COM. To invoke the file for operation you would type in BRS and press **RETURN** while at the CP/M command mode prompt. This appears as:

```
A>BRS (then press RETURN)
```

When BRS.COM is invoked, the program will cause this,

```
  Z67 Winchester Disk Backup/Restore System  (BRS)
--------------------------------------------------------
Release Ver. 1.0               Copyright (C)   July 1981

               Heath/Zenith Data Systems


Enter Today's Date. (MM/DD/YY)   ====>
```

to appear on the monitor.

Today's Date:

The first prompt that will occur when you invoke BRS is an enquiry for the current date. This date enquiry is to allow the system to keep track of the date that a backup was made. The prompt for the current date is:

```
Enter Today's Date.  (MM/DD/YY)   ====>
```

The program requires a date to keep a record of when the Backup operation was performed. That date allows the system to differentiate between disk sets, and provides an orderly method of filing different backup copies containg the same files. Chronological files may be kept by the user in this manner.

The date that the user enters is checked to ensure that all characters are numeric (other than the "/"'s), that the month is less than 13 and that the day is less than 32.

If the date that is input is the wrong date (either you meant to put in another date or used, for example, yesterday's date by mistake), the date may be changed from the menu that will appear during BRS operation.

> NOTE: The date prompt requires two digits in the year column, the month and day columns do not. Also, for the creation of special files, zeros (00) are permissible as a day, month, or year.

Invalid Dates:

Some examples of invalid dates would be:

====>12-10-82	(will not accept hyphens)
====>7\8\93	(invalid field seperator)
====>18/3/78	(the month column exceeds 12 months. No European style dates.)
====>12/32/99	(the day column exceeds 31 days.)

Date Errors:

When an invalid date format has been entered, the program announces,

```
Syntax Error
```

and prompts again for the correct date. When the date given is outside of the parameters allowed for in each column, the program responds with,

```
Invalid Date Entered
```

and the prompt is repeated.

Disk Drive Specification:

After the date prompt has been properly answered, the program will ask what the device names are for the disk drives being used. The first device prompt will appear:

```
Enter Winchester Disk Drive Spec.  (A:-P:)  ====>
```

Here, the user is to enter the device name of the Winchester disk, or the partition on the Winchester disk where the user wants to perform file operations.

An example of a correct device specification would be:

```
Enter Winchester Disk Drive Spec. (A:-P:) ====>A  RETURN
```

This prompt recognizes only the first character that is entered. A user response of A or A: is acceptable as the device or partition named "A:".

On receipt of a valid response from the user, the program continues with the next prompt:

```
Enter Floppy Disk Drive Spec. (A:-P:) ====>
```

The response by the user to this prompt must meet the same qualifications that the prompt for the Winchester disk specification required. An example of a correct entry would be:

```
    Enter Floppy Disk Drive Spec. (A:-P:) ====>C RETURN
```

Drive Specification Errors:

If the user inputs an invalid device name, such as "Q:" (only device names A: through P: are acceptable), the program informs the user of the error with:

```
     Invalid Drive Specification
```

The program then prompts again for a correct device name.

If the user selects a valid device name that is valid but is not currently assigned to the Winchester or Floppy Disk Drives in the Z67,the following message will be displayed:

```
             Drive not Available in Current Configuration
```

Section Two: Master Menu Operation

The rest of this chapter will cover all of the operations that may be accessed from the menu. Each operation will be discussed in the order that it appears on the menu. If particular options are associated with an operation, these options will be explained at the point that their selection may occur. The primary options are also given a full description under "Master Menu Options" section, below.

Ending the Program:

At any point during the course of this program, pressing CTRL and C simultaneously will exit BRS and return you to the CP/M command mode. Also, in response to the prompt at the Master Menu, you may type in the character "E" (for EXIT to CP/M) and press **RETURN**.

If the initial boot was performed from the floppy disk in the Winchester Disk System, when "E" is entered from the master menu, BRS will request:

```
Place a Bootable Disk in Drive A:

Enter Carriage Return When Ready
```

The Master Menu:

All operations and transactions begin and end at this menu. The operations and options that are displayed by the Master Menu are:

```
                  BACKUP AND RESTORE MASTER MENU
              ---------------------------------------

                      D   DATE Change
                      B   BACKUP Creation
                      R   RESTORE Files
                      C   COMPARE Files
                      L   LIST Directory
                      E   EXIT to CP/M

    OPTIONS: Valid Only on BACKUP(B) and RESTORE (R) Operations

               V = Verify all files after writing.  (B/R)
               W = Disable Warning messages.  (B/R)
               A = Allow R/O Files For Restore. (B/R)
               F = File Deletion after saving.  (B)
               P = Prompt for all actions.  (B/R)

    Select Operation (X /Y/Y/Y)     ====>
```

Master Menu Options:

The prompt that is displayed at the bottom of the menu,

```
Select Operation (X /Y/Y/Y)    ====>
```

has several options available, where the "X" is an operation code and each "/Y" is a switch.

> NOTE: No spaces should be inserted between an operation and a switch, or between switches.

Any of the operations may be performed without options by typing one of the seven, character codes ("D", "B", "R", "C", "L", or "E") and then pressing **RETURN**. The command format is represented in the prompt by the "X" (shown within the parentheses). Only one operation may be selected at any one time.

Five options may be utilized in the form of switches ("/V", "/W", "A/", "/F", or "/P"), as shown by the "/Y" in the prompt's parentheses. These switches are the primary options that are available for option selection from the main menu, and would be entered directly after the Backup or Restore command codes. These options may only be used with the Backup and Restore commands. The parentheses to the right of the option list shows the key character of the operations that they may be used with. (See: "BACKUP CREATION" and "RESTORE FILES" for an explanation of the option usage.) Multiple switches may be used with the appropriate operation.

An example of the Restore operation with the applicable, primary switches might be:

```
Select Operation (X /Y/Y/Y) ====>Restore/V/P
```

It is not necessary to fully type "Restore". When the first character of an operation is typed, the command word is automatically completed. Upon typing the "R", the program will immediately display the "estore". The two switches entered, "/V" and "/P", signify that the program should Verify ("/V") the restored files to ensure that the copies are identical to the source, and that the program must Prompt ("/P") the user before it performs any action.

An invalid selection to this prompt will cause the system to report a syntax error and redisplay the selection prompt.

Section Three: Date Change

The first operation listed on the menu is "Date Change". This operation is handled much like the first prompt that appears and requests the current date. The same format for date entry is used, and the same error messages will result if an invalid date entry is made. (See: "Today's Date", above on page 68.)

The date operation allows the date to be changed that was input during the initial prompt, in case that date was incorrect. The date is necessary to the BRS program because it allows a method for it to distinguish between different disks that may have files with identical names on them. The date also allows a method to determine which backup disk was the most recent one made, which is useful since the backup that is the most recent would generally be the most up-to-date.

Typing a "D" (which is completed as "Date Change") and pressing the **RETURN** key while at the Master Menu's prompt will cause this prompt:

```
     Current Date is 10/10/92

     Enter Change else hit RETURN ====>
```

The date that is shown is the date that was entered in response to the initial date prompt. To make a change, enter a new date and press **RETURN**, which will return you to the Master Menu. If you press **RETURN** without entering a new date, the system will retain the date that is shown as the current date.

Section Four: Backup Creation

The creation of a backup copy of a disk is extremely important. Backup copies provide some security in the event that an unforeseeable disaster might permanently destroy irreplacable files. This might include such things as a hardware failure in the Winchester Disk System, erroneous operation of a program (erasing files when they were meant to be saved), or power fluctuations, which might cause uncontrolled write operations to the disk.

The Backup and the Restore operations are the most complicated operations that may be performed by BRS. This is because they have the most variations and options available. However, because both of these operations are so similar, this section on Backup creation is the longest of the two in order to avoid a lot of unnecessary repetition of the same instructions.

To begin the Backup operation, type B. After the "B" you may enter any of the options that are listed on the menu with an "(B)" or "(B/R)" after them. Then press the **RETURN** key.

The format for the Backup operation with options is:

```
Select Operation (X /Y/Y/Y)     ====>Backup/V/F/P
```

The "B" is the command for the Backup operation, and the "/V/F/P" are the three options selected as an example. Notice how the program completes the command by adding "ackup" directly after the "B" that the user entered.

Primary Options:

A detailed description of each option that is available from the Master Menu, follows:

/V--is the Verify option. This option checks each byte of the destination file against each byte of the source file to see that both files are identical after a file has been transferred. If the two files are not identical, this option reports an error message and states the record number (in hexadecimal) where the discrepancy occurred.

The "/V" option is available with both the Backup and the Restore operations.

/W--is the Warning Message Disable option. Selection of this option suppresses all warning messages that may occur during the operation. These warning messages are of two types, and occur when the user attempts to:

1) format a disk
2) delete files from the source unit

When the "/W" option is specified, the program will perform the requested command without warning the user that one of these conditions is going to occur. The "/W" option is available during both Backup and Restore operations. The prompts that occur in operation of deleting files from the Winchester disk will be overidden, and no prompting will occur.

/A--is the option that allows R/O files to be restored even though files of the same name already exist on the Winchester disk (it does this by deleting the file of the same name from the Winchester disk first and then restores the requested file). If the "/A" option is not selected and a R/O file exists on the Winchester disk, the following message appears:

```
Found User#:00 BRS .COM : File is R/O, Not Being Restored
Enter Carriage Return When Ready
```

/F--is the File Deletion option. Selection of this option causes the program to delete the files from the source disk after the files have been saved to the destination disk that is being used for backup. The "/F" option is only available while using the Backup operation.

/P--is the Prompt option. If the "/P" option is selected, the user must respond to a prompt for each action that the user requests the program to perform before that request is performed. When the "/P" option is selected during the Restore operation, for example, the system would ask the user if the existing files on the Winchester disk may be deleted. Only those files on the Winchester disk that have names that are identical to those being restored can be deleted. The "/P" option is available during both the Backup and the Restore operations.

File Specifications:

When a file or series of files are to be transferred by the Backup (or Restore) operation, the user must specify the names of the files that are to be transferred by the operation, and the names of the files that are not to be transferred. Based on the information given to these two prompts, BRS creates a list of files that the ensuing operation will affect.

The first, file-specification prompt asks for the names of those files that are not to be transferred by the operation. This is the Rejection File Specification prompt. This prompt will cause all of the filenames that are entered to be left out of the list of files that will be transferred during the operation. (Further details are covered under "Rejection File Specification", on page 76.)

The second, file-specification prompt will ask for the names of the files that are to be transferred by the operation. This prompt is the Selection File Specifications prompt. All of the filenames that are specified in response to this prompt will be placed in the list as files to be transferred by the operation. (More information is given in "Selection File Specification", below.)

Rejection File Specification:

If a Backup or Restore operation is selected, the prompt,

```
Enter Rejection File Spec(s). ====>
```

will appear.

An example of this procedure would be:

```
Enter Rejection File Spec(s). ====>TESTFILE.DOC   RETURN
```

Filename responses that are given to this prompt are files that will be excluded from the list of files that are to be backed up or restored. Even if the same files are named in response to the next prompt ("Enter Selection File Spec(s). ====>"), they will still be excluded from the operation. That is, the Rejection File Specifications override the Selection Files Specifications.

The responses (and their results) to this prompt may be of three types:

1--a CP/M filename may be entered:

```
Enter Rejection File Spec(s).  ====>TESTFILE.ASM
```

- the file named TESTFILE.ASM would be put in the list to be ignored by the Backup operation (assuming we had requested the Backup operation from the Master Menu).

2--the CP/M filename of a batch file preceded by a semicolon (;) may be entered that contains a list of rejection files specifications.

```
Enter Rejection File Spec(s).  ====>;BATCHFIL.SUB
```

- the batch file, named BATCHFIL.SUB in this example, must be prefixed by a semicolon (;). All of the filenames listed in this batch file would be added to the list of files that are not eligible for selection in the ensuing operation.

3--a **RETURN** may be entered.

```
Enter Rejection File Spec(s).  ====>RETURN
```

- the operation would assume that a **RETURN**, pressed in response to this prompt, means that there are no more files to be added to the list of files that are ineligible for selection.

All users' files are affected by this operation, i.e., it does not test for a user number match before rejecting the file from the operation.

> NOTE: No drive names are allowed in response to the "Selection File Spec(s)" prompt. Standard CP/M wildcards ("*" and "?") are allowed.

BRS allows a maximum of forty (40) file rejection specifications to be entered.

When **RETURN** is entered without a filename, the program assumes that all of the files to be rejected have been entered. The program then continues on to the next prompt.

Selection File Specifications:

The **RETURN** in response to the "Rejection File Spec(s)" prompt will cause the program to continue on to:

```
            Options for File Selection Spec(s).
      -----------------------------------------------
                 A  - All File Types  (Default)
                 N  - Nonsystem
                 S  - System
                 U  - Current User #  (Default)
                 U* - All Users
                 Un - One Specified User #

      Enter Selection File Spec(s). (X /Y/Y/Y)  ====>
```

The responses (and their results) to this prompt may be of three types:

1--a CP/M filename may be entered, with or without specific options.

```
Enter Selection File Spec(s).  ====>TESTFILE.ASM
```

- the file named TESTFILE.ASM would be put in the list for the Backup operation (assuming we had requested the Backup operation from the Master Menu).

2--the CP/M filename of a batch file preceded by a semicolon (;) may be entered that contains a list of selection files specifications.

```
Enter Selection File Spec(s).  ====>;BATCHFIL.SUB
```

- the batch file named BATCHFIL.SUB, which must be prefixed by a semicolon (;), would be submitted. All of the filenames listed in that file would be put in the list of files to be affected by the operation. (See: "Creating a Batch File Specification List", on page 80.)

3--a **RETURN** may be entered.

```
Enter Selection File Spec(s).  ====>RETURN
```

- the operation would assume that a **RETURN**, pressed in response to this prompt, means that there are no more files to be put in the list to be operated on. When the **RETURN** is pressed, the BRS program performs the operation on all of the filenames that are in the list, and then returns the user to the Master Menu.

Each individual filename or each filename for a batch file that is entered may utilize the options that are listed on the menu with the "Selection File Spec(s)" prompt. The options determine the types of files that will be affected by the operation of either Backup or Restore. These options are described below in the "Selection File Options" section.

NOTE: Drive names are not allowed in response to the "Selection File Spec(s)" prompt. CP/M wildcards ("*" and "?") are allowed.

When a nonexistent filename is specified in response to this prompt, the message

```
No file found for Entered Spec.
```

is displayed on the terminal.

Selection File Options:

Each option here is a limiting switch that identifies the file type and user number of the files named in the selection file specification. These switches are identified as secondary switches to differentiate them from the primary switches available from the Master Menu.

```
            Options for File Selection Spec(s).
      --------------------------------------------------

                  A  - All File Types  (Default)
                  N  - Nonsystem
                  S  - System
                  U  - Current User #  (Default)
                  U* - All Users
                  Un - One Specified User #

      Enter Selection File Spec(s). (X /Y/Y/Y)   ====>
```

When a filename.ext is entered in response to the selection file prompt, the user may enter options. An example of which is given by the prompt as "Enter Selection File Spec(s). (X /Y/Y/Y) ====>" prompt, where "X" is a proper CP/M filename and each "/Y" is an appropriate option switch. These options may be entered as switches directly after the filename (shown in the prompt as "/Y/Y/Y"). If no options are entered, the program assumes the default values for each option (shown on the menu in parentheses).

The description of these secondary, limiting switches are as follows:

/A--is the switch for All System and Non-System files, and enables the Backup or Restore operations to transfer both System and Non-System files.

/N--is the switch for Non-System files, and allows only Non-System files to be transferred.

/S--is the System files switch, and allows only System files to be transferred.

/U--is the switch for the Current User, and enables only those files belonging to the Current User to be transferred.

/U*--is the All User files switch, and allows all users' files to be transferred.

/Un--is the switch for files of User number "n", where "n" is an integer from zero (0) to fifteen (15), inclusive. It allows only the files of User number "n" to be transferred.

Another example of a filename with options might be:

```
Selection File Spec(s) ==>TESTFILE.COM/N/U*---
```

Here, **TESTFILE.COM** is the filename, **/N** is a limit for only Non-System files, and **U*** allows all user files to be affected.

Selection File Errors:

During the operation of input to the Selection File, two types of errors are common:

Invalid Option Format or Selection

and

Invalid User Number or Format

If either error occurs, correctly retype the Selection File Specification.

Backup Option Defaults:

The default values for the Backup options are marked on the menu: "A - All File Types (Default)", and "U - Current User # (Default)". If the Backup operation is performed without secondary switches, it will affect all file types that may belong to the current user.

Creating a Batch File Specification List:

Any editor that is capable of creating a text file may be used to create a Batch File for use as a Specification list. The CP/M ED.COM (editor) will work fine.

The Batch File may be opened under any valid CP/M filename and with any extension. The names of the files to be specified are then entered, one to a line. Each line must then be terminated with a carriage return. For example, examine this sample Batch File, TESTLIST.BAT:

```
ACCOUNTS1.DAT
ACCOUNTS2.DAT
PAYROLL2.DAT/U3
INVOICE1.DAT
ADVENTUR.BAS
FINANCE.COB
STATS.FOR/S/U5
LETTERS.TXT
```

When called in response to either the "Selection File" or "Rejection File" prompts, TESTLIST.BAT will be opened and the required operation will be performed on each of the files contained in the filename list. The Batch File may be called with any options available to the particular operation being performed.

Calling a Batch File Specification List:

If a filename of a batch file that contains a list of Selection File Specifications is called, that filename must be entered with a preceding semicolon so that it would appear as ";filename". If a filename for a batch file is entered as a response by the user and that file is not found, the error message

```
Submit File Not Found
```

and BRS will return to the file specification prompt. Using the name of the Batch File example given above, this would be performed as:

```
Enter Selection File Spec(s). (X /Y/Y/Y) ====>;TESTFILE.BAT
```

This would cause BRS to open a Batch File named TESTFILE.BAT and use each of the filenames contained therein as the specified files on which to perform its operation. Options may be specified directly after the filename of the Batch File, exactly as they may be specified after any filename. BRS displays each filename in a batch file when it uses each file as a file specification.

> NOTE: Option switches are ignored if they are appended to the filename of the batch file. But switches may be added to the filenames within a batch file.

Ending the Selection File Specification:

When entries to this prompt are completed, press **RETURN** in response to the prompt. The **RETURN** response will cause the Backup or the Restore operation to be executed, and then the program will return the user to the menu.

Long Files or File Overflow:

If a file is so long that it cannot be completely contained on one destination disk or if a series of files has filled the disk and there are more files queued in the Selection list, the user will be instructed to insert a new disk and the operation will continue. This allows the backup or restoration of a file or a series of files whose quantity is larger than an individual floppy disk can hold.

Directory Save:

When all of the files that were specified by the user have been copied, the user will be asked to reinsert the first disk of the backup disk set and the working directory will be updated to that disk. The working directory will then be deleted from the Winchester disk.

File Delete Option:

If in response to the Master Menu prompt, the user specified the "/F" (File Deletion) option, the files that were saved to the floppy will be deleted from the Winchester disk. No files will be deleted until the Backup transfer has been successfully completed.

If the user selected to be prompted by the BRS program in response to the Master Menu prompt, the user will be asked by the program whether or not to delete a given file before it actually deletes that file. The message that would appear would be:

```
Found User# 00 TEST.ASM on Winchester Disk.  Delete? (Y/N)<Y>
```

Here, TEST.ASM would be the filename that BRS had located from its list of files to be deleted. The question is to be answered with either a "Y" or an "N". The default of "Y" (shown as <Y> on the monitor) is assumed if a **RETURN** is pressed without typing either "Y" or "N". Typing "N" will cause BRS to skip over that particular file and not delete it.

Also, when using the delete option (with the "/D" switch), if the warning messages are active, the user will be asked to verify each file that is to be deleted. If the user presses **RETURN**, the files will not be deleted. If any other key is pressed (anything except the **RETURN** key), the files will be deleted. The message that occurs during this operation is:

```
*****Warning! Files on Winchester Disk are Going to be Deleted*****

              Enter (CR) to Cancel Deletion Process
```

If the warning messages are disabled by the "/W" option switch, BRS will over ride the prompting of deletion selection, and delete all of the selected files.

During the Backup Operation:

When all Rejection and Selection file specifications have been entered , the screen will clear and the following message will be displayed.

```
              Load Drive X: with a Blank Floppy Disk

       ***WARNING Data on this Disk Will be DESTROYED!! ***

                  Enter Carriage Return When Ready
```

The "X" would be the drive name of the floppy disk drive. After **RETURN** is pressed, the program will prompt:

```
Which density? (S=single, D=double) ====>
```

Enter the letter designating which of the two densities you want to use to store the files. When that is entered the terminal will display:

```
Press RETURN to begin.
```

Press **RETURN**, and the operation will continue.

If the files fill up the floppy disk and there are more files listed as Selection Files, you will be instructed:

```
                 Load Drive X: with a Blank Floppy Disk

          ***WARNING Data on This Disk Will be DESTROYED!! ***

                     Enter Carriage Return when Ready
```

If for some reason one of the floppy disks is unformatable, the following message will appear:

```
Unable to format this disk. Place a different disk in the drive.
```

Section Five: Restore Files

The Restore operation's primary purpose is to recover or restore files from a previously generated backup copy that was created. This operation reverses the process that was performed on the original files when a backup copy was created. The Restore operation restores the files to their original configuration should the need arise to work with the backup copy.

The Restore operation is started from the Master Menu by typing **R** and then pressing **RETURN**. The Restore operation is essentially identical to the Backup operation (see: "BACKUP CREATION" above, for complete details). The primary difference is that the files are transferred to the device specified as the Winchester disk from the device specified as the floppy disk, whereas the Backup operation transfers files from the specified Winchester disk partition to the specified floppy disk. There is one exception to the usable options.

Invalid Option:

When the Restore operation is requested from the Master Menu, it may not be used with the "/F" (File Deletion) option. The "/F" option is only selectable with the Backup operation. It is marked on the Master Menu as selectable with (B) Backup only. If it is entered as an option, BRS will ignore it.

Directory:

Another difference between the the Backup and Restore operations is that Restore will first ask for the Directory Disk to be inserted. This disk provides the information necessary to the Restore operation so that it can prompt for the correct disks to be inserted and so that it knows the location, Volume Number, and Dates of the files that are being restored. This Directory is written to the first disk created during the Backup operation, which is also the disk that the program asks to update at the end of the Backup operation.

Directory Error Message:

Should the user insert a disk that has no directory written on it, an error message will be generated.

```
Wrong Disk Inserted!!
Enter RETURN For Master Menu.
```

When **RETURN** is pressed, the program will return the user to the Master Menu.

Operation and Options:

The Restore operation uses the same command format and options that are available with the Backup operation. (See: "BACKUP CREATION" for further details.) Type R,followed by any options, from the Master Menu to begin the Restore operation. Restore will then ask for the directory disk of the disk set that you wish to use to restore the previously generated backup files from.

```
Load Drive X: with Volume 01 of Disk Set.
Enter RETURN when ready.
```

In this prompt the "X:" device designation is the device that was specified as the Floppy Disk Drive during the initial BRS prompts. "Volume 01" is the directory volume number of the disk set that the user is going to perform Restore with.

The BRS program checks to see that this is indeed a Directory Disk, and if it is, BRS then displays,

```
Backup Disk Set:  Created  12/27/82
                  Start vol. 01
                  Last  vol. nnn

Is This The Correct Backup Set? (Y/N)<Y> ====>
```

where "nnn" is the highest Volume number in the disk set that is indexed by that directory. If this is the desired disk set, the user types **RETURN** (for the default of <Y>, Yes) or **Y** and presses **RETURN**. Type **N** and **RETURN** if it is not the correct set. With an "N" response, BRS will ask for the Directory Volume again.

The Restore operation then continues on to the entry of the Rejection File Specification (see: "File Specification" under "BACKUP CREATION", above). After the Rejection Specification is completed, Restore will prompt for Selection File Specifications (see: "Selection File Specification" under "BACKUP CREATION", also above).

When these two File Specification prompts have been completed, Restore compares the list of selected files that it has created against the directory to determine the location of each file. Restore then prompts for each Volume to be loaded that contains a file or files to be transferred.

An example might be:

```
Selection File Spec(s). ====>TESTFILE.DAT    RETURN

Selection File Spec(s). ====>RETURN

Load Drive C: with Volume 02 of Disk Set.
Press RETURN when ready.
```

```
    Load Drive C: with Volume 03 of Disk Set.
Press RETURN when ready.

    Function Complete.
```

This would continue until the program has restored all files that were specified by the user in response to the Selection Specification prompt. After completion, the program will return to the Master Menu for further operations.

Wrong Disk Error:

At any point if the user inserts the wrong disk into the drive, the error message

```
  Wrong Disk Inserted!!
  Enter RETURN when ready.
```

will appear, and the user will then see the prompt:

```
  Load Drive X: with Volume 00 of Disk Set.
  Enter RETURN when ready.
```

where the "00" is the appropriate Volume number.

Section Six: Compare Files

When a backup copy is created or when a files needs to be restored from a backup copy, it is critical that the newly made copy contains the exact same data as the copy the file was made from. When large amounts of data are transferred to or from various media, it is extremely important to be able to determine the integrity of the transferred data. The "/V" option allows verification of this sort at the time the files are being transferred. If files are updated later on or if the "/V" option was not selected during the transfer stage, Compare will allow the user to ascertain integrity.

The Compare operation begins when the user has entered a "C" and pressed **RETURN** in response to the menu's prompt. This operation starts with the prompt:

```
Load Drive X: with Volume 01 of Disk Set.
Press RETURN when ready.
```

The "Drive X:" in this prompt would be the drive designation that the user specified as the Floppy Disk device in the initial prompt sequence. "Volume 001" is the Directory Disk of the Disk Set that the user wants to perform a compare operation on.

The program checks to see that the disk that is loaded is a Directory Disk and if it finds the Directory, it will display,

```
Backup Disk Set:  Created  10/17/82
                  Start vol. 01
                  Last  vol. nnn

Is This The Correct Backup Set? (Y/N)<Y> ====>
```

where "nnn" is the highest Volume number that is indexed by that Directory.

The Compare operation will then prompt:

```
                Compare Function
     ------------------------------------------

Enter Winchester Disk Filename ====>
```

To this prompt, the response should be the name of the file to be compared that is on the Winchester disk. After entering this filename, press **RETURN**.

NOTE: If a device name is entered in response to the Compare prompts, the error message

```
Drive Specifications NOT allowed.
```

will be displayed. This is because the devices were already specified during the initial prompt sequence. CP/M wildcards (the "*" and the "?") are also not allowed during the Compare operation.

The Compare operation will then prompt,

```
Enter Floppy Disk Filename ====>
```

where the response would be the filename of the file on the device specified as the floppy disk. After entering the name of the file that the Winchester disk filename is to be compared against, press **RETURN**.

Compare will next request the specific volume be entered where the file is located. An example would be,

```
Load Drive C: with Volume 014 of Disk Set.
Enter RETURN when ready.
```

where "C:" would be the device designation that the user specified was the Floppy Disk device, and "Volume 14" is the volume that contains the specific file that is to be compared.

The Compare operation compares each byte of both files. If the files are verified to be identical, the prompt,

```
Compare Complete (Hit RETURN For Master Menu)
               Compare Function
---------------------------------------------

 Enter Winchester Disk Filename ====>
```

will be displayed again, and another comparison may be made.

NOTE: The Compare function may be used to compare the current user's applications. The CP/M "User" command must be used to change the current user number if files belonging to other users are going to be compared.

Compare Error:

If the files do not compare exactly, the program will indicate that the data did not compare, and give the hexadecimal number of the record where the error was found. When a place is found where the two files are not identical, the Compare prompt will be repeated.

In this instance, the user must determine which of the two files should be deleted and then either performs the Backup or the Restore operation on the file again.

The following is an example of the display that will appear when two files are not identical.

```
                   Compare Function
 ---------------------------------------------

 Enter Winchester Disk Filename ====>TESTFILE.TXT

 Enter Floppy Disk Filename ====>TESTFILE.TXT

 Load Drive C: with Volume 014 of Disk Set.

 Enter RETURN when ready.
                                (a momentary pause
 Reading File TEXTFILE.TXT       occurs here.)

 Data Miscompared at Record 000E Reading file TESTFILE.TXT


                   Compare Function
   -------------------------------------------

 Enter Winchester Disk Filename ====>
```

Ending Compare:

The Compare operation may be terminated by pressing RETURN in response to either file prompt. Upon termination, the Master Menu will be redisplayed.

Section Seven: List Directory

The List operation provides the user with a means of accessing the directory of his files. It provides the additional information besides the filename that is necessary to distinguish between disk sets containing identical filenames. The List operation gives the Date that the copy was created, the number of Volumes in that particular disk set, the User Number of each file (to whom the file belongs), and the Volume number of the disk where a particular file is located.

In response to the Master Menu prompt, if the user types "L" and presses **RETURN**, the user will be instructed to insert the "01" volume of a disk set. The BRS program then checks to see that this is indeed a Master Directory, and if so, it then displays:

```
     Backup Disk Set:  Created MM/DD/YY
                       Start vol. 01
                       Last  vol. nn

     Is This The Correct Backup Set? (Y/N)<Y> ====>
```

If the Volume that is inserted is not the Master Directory of a disk set, BRS will state:

```
     Wrong Disk Inserted!!
     Enter RETURN For Master Menu.
```

An example of a sample directory list appears below.

```
                      Listing of Backup Directory
                          Created: 02/15/80
                       Highest Volume Written: 03

     FILENAME     USER   VOLS       FILENAME     USER   VOLS
     --------     ----   ----       --------     ----   ----
  C:TEST1    COM   00    01-01   C:TEST     REL   03    01-01
  C:TEST     ASM   03    01-01   C:TEST     PRN   15    01-02
  C:TEST     COM   07    01-01   C:FILE1    ASM   15    01-02
  C:FILE2    ASM   15    02-02   C:FILE3    ASM   09    02-03
  C:FILE4    ASM   15    03-03
```

CHAPTER SIX: THE CONFIGURATION UTILITY

- A Basic Description of the CONFIGUR.COM program.
- How to Begin Configuration.
- The Standard Heath/Zenith Configuration.
- The Options that are Available from Configur's main menu.
- Terminal and Printer Configuration Options.
- The Disk Parameter Options.
- Options for the Default Input/Output Devices.
- Automatic Program Control for Warm and Cold Boots.

The Configuration program is designed to facilitate user customization of Heath/Zenith's CP/M BIOS to a particular operating environment. Use of this program allows the user to set the characteristics of the terminal, printer, disk drives, and the default, logical mapping for input and output to physical devices.

CONFIGUR is run by typing **CONFIGUR** and pressing **RETURN** from the CP/M command mode prompt. Generally, the user may wish to run it after first installing a system, and then it might not be used again until the user decides to add another piece of hardware to the system.

When run, CONFIGUR will identify itself and then determine the hardware available. The program will automatically determine the amount of Random Access Memory (RAM) that is available for use by CP/M, the number of serial ports, and the number of disk drives. When CONFIGUR tests for the disk drives, the program will select each (potential) drive and attempt to determine if that drive is available (connected and active). There does not need to be a disk in each drive for this particular test. However, if the drives are to be considered for configuration purposes (i.e., to be counted as devices that CONFIGUR will include in the configuration process), they must be powered up and connected to the system.

The Configuration Utility Basic Description

NOTE: If you are using the H8 computer with an H8-4 serial card, you will be required to type spaces in order to continue the program. Typing these spaces enables the program to determine the baud rate that is used by your terminal.

- How to Begin Configuration.
- The Standard Heath/Zenith Configuration.
- The Options that are Available from [illegible] main menu.
- Terminal and Printer Configuration Options.
- The Disk Parameter Utility.
- [illegible] for the Default Initial [illegible].
- Automatic Program [illegible]

Section One: Beginning CONFIGUR Operation

When CONFIGUR has been invoked, it will commence by printing a summary of the hardware that it locates. An example of this summary might appear as:

```
32K HEATH/ZENITH CP/M 2.2.03
FOR Z67 DISKS WITH OPTION(S) P2I

HEATH/ZENITH CONFIGURATION PROGRAM
VERSION 2.2.03
SERIAL NUMBER: nnn-nnnnn

THIS PROGRAM CONFIGURES THE CP/M OPERATING SYSTEM TO A
PARTICULAR HARDWARE ENVIRONMENT.

PLEASE WAIT DURING HARDWARE VERIFICATION...

H/Z89 WITH 64K OF RANDOM ACCESS MEMORY  (RAM)
Z67 8 INCH HARD/FLOPPY DISK INTERFACE
CRT BAUD RATE IS 9600
00 ADDITIONAL PORTS FOUND


DRIVE A DISK IS WRITE PROTECTED.
MODIFICATIONS WILL NOT BE MADE TO THE DISK FOR THIS CONFIGUR RUN.


STANDARD SYSTEM (Y OR N)? <Y>:
```

The amount of RAM (memory that may be read from or written to), the number and type of disk drives, and the number of serial ports will vary, depending on the particular hardware that is present. What is displayed on your terminal will be dependent on your particular hardware environment.

> NOTE: If configure is run from a disk that is write-protected, it will warn the user that it will only modify the copy of BIOS that is currently resident in memory, and that it will not change any of the values that are in the BIOS on the disk. This can be useful in testing a new configuration (or during the preliminary boot of the system).

You may now select the "Standard System" by typing a "Y" to the prompt given at the end of the display just presented. Selection of the "Standard System" will configure the BIOS for the standard hardware configuration that is suggested by Zenith Data Systems. The configuration will now be adjusted to reflect the hardware that CONFIGUR has found. (The Heath/Zenith Standard System Configuration is detailed in Section Two on page 96.

Consistent Version Check:

CONFIGUR checks that it and the BIOS are consistent in version number, otherwise the program might modify the incorrect portions of a BIOS since the various versions have used different locations for the storage of various values.

If the program finds that the BIOS is not of the same version, an error message,

```
INCONSISTENT Version number...can NOT configure!!
```

will result and the program will abort. This type of inconsistency may be a result of not copying the most recently released version of the BIOS.SYS file onto the disk in drive A, or of using an outdated version of CONFIGUR. If you are unable to correct the problem, call or write to Heath or Zenith Data Systems.

Section Two: The Heath/Zenith Standard System

The "Standard Heath/Zenith System" consists of the following (each of the items that are listed below will be fully discussed later in this Chapter, in their respective sections):

Number of drives found, step-rate set to 30ms.

CRT at port 350Q, 9600 baud, no nulls.

TTY at port 320Q, 300 baud, no nulls, no uppercase mapping.

MODEM at port 330Q, 300 baud, no nulls, no uppercase mapping.

Line printer at port 340Q, 4800 baud, no nulls, no uppercase mapping.

ECHO on delete on console.

IOBYTE set as: CON=CRT, RDR=UL1, PUN=UP1, LST=LPT. (See the discussion on the "Default I/O Configuration Sub-Menu" for an explanation of these settings.)

Printer Ready Polarity: LOW

Printer Ready Signal: RTS (Pin 4)

Detailed Disk error messages set FALSE.

Automatic program control for warm boot set FALSE.

Automatic program control for cold boot set TRUE.

Automatic program command line is set for CONIGUR.

Section Three: The Main Menu

If you do not choose to use the "Standard System" configuration, you would type N in answer to the initial configuration prompt, as shown above in "Beginning Operation". When an "N" is given to that prompt, alternate options will appear in the form of a series menus. The user may select any of the options that are desired, which conform to the particular hardware that is involved. The first menu that appears on the screen is the main menu. Its sole purpose is to enable the user to end the CONFIGUR program or to select one of the other menus that contain the options the user wants to check or adjust. The main menu will appear on the console as:

```
CP/M Configuration

A    Set Terminal and Printer Characteristics
B    Set Disk Parameters
C    Change the Default I/O Configuration
D    Automatic Program Control

X    Configure, making changes to memory only
Y    Configure, making changes to both memory and disk
Z    Quit, making no changes

Selection:
```

The options in this menu, and those menus that follow, are selected by typing the correspondent letter code that is displayed to the left of the option that is desired. As example, the user would type B to select the "Set Disk Parameters" menu.

Option "X" on the main menu will make all of the configuration changes to memory only. This makes a temporary change to the BIOS and will only be active until the disk copy of the BIOS is reread into memory, during a cold boot. This selection is recommended when you need to test any changes, so that you can try those changes before making that configuration of BIOS permanent.

Option "Y" will only be displayed if your disk is not write-protected (see "NOTE:" below). If you select this option, both the BIOS resident in memory and the BIOS that is stored on the disk will be changed. This change is considered a permanent change (see "CAUTION:" below) because from there on that altered BIOS will be the one loaded when that disk is used to do a cold boot.

> NOTE: Configure warns the user in the initial hardware summary that it will only modify the copy of BIOS that is currently resident in memory and that it will not change any of the values that are in the BIOS on the disk if that disk is write-protected.

> CAUTION: Though this option creates a BIOS that is considered to be permanent, it may be reconfigured again to reflect other changes, unless you have configured it in such a way that no input or output from your existing hardware can take place, and if it were your only existing copy of the BIOS (hopefully you have made backup copies of your disks and it is not you only copy). Therefore you must exercise extreme caution, preferably by first utilizing the "X" option to pre-test a newly configured BIOS to see that it works properly before saving it to disk.

Option "Z" is provided to safely take you out of the CONFIGUR program without changing any of the preexistent values in the BIOS. If you have any doubts about the correctness of any changes that you have made, you can always return to CONFIGUR after consulting your documentation and thinking for awhile.

Each of the sub-menus also provides a means of returning to the main menu via either a "Y" or a "Z" option from their lists of possible selections. The "Y" option in a sub-menu will save the changes that have been made and then return to the main menu. The changes are not actually made at this point but are stored until you exit the program. The "Z" option in a sub-menu will cancel any changes that were made with that sub-menu and then return to the main menu.

An invalid input by the user will result in a "BELL" character (beep) on your console. If this occurs, reselect the option and reenter it. When an entry has been made, a single carriage return (RETURN) after the new value is entered will cause that submenu to redisplay. The new value will then show in place of the value that was previously listed.

Section Four: Terminal/PrinterCharacteristics Sub-Menu

The terminal and printer characteristics sub-menu allows the user to set the physical port and baud rate assignments for the serial devices in the system. It also allows you to specify that the device is capable of accepting only uppercase information, in which case the BIOS will convert all lowercase information, which is directed to that device, to uppercase before it outputs it.

Additionally, you may specify the number of "null" characters to be sent after a carriage return (**RETURN**). The number of "nulls" specified to occur after pressing **RETURN** will provide the amount of delay that is required by some devices to return the printhead/cursor to the lefthand side of the carriage/screen.

Further, this sub-menu allows selection of the RS232C line and polarity of the "printer ready" signal. Polarity, as used here, is a voltage level. Two levels of voltage are used by the computer/printer line connection for the "printer ready" signal. Low polarity, the lesser of the two voltage levels, is used by some printers to tell the computer that the printer is ready for more text. Other printers use High polarity, the greater of the two voltage levels, when the printer is ready to receive text. Most Heath/Zenith printers use the Low polarity signal but you should refer to your printer's operation manual to determine what signal line and polarity is used.

The RS-232C lines that a printer generally uses to let the computer know its status are the DTR (Data Terminal Ready) and the RTS (Ready To Send) lines. The DTR line (pin 20) signals to the computer when the printer is powered up. The RTS line (pin 4) tells the computer when the printer is ready to operate. Manufacturers of printers other than Zenith Data Systems sometimes use these two lines differently, hence they have been made user-selectable.

The characteristics sub-menu that allows the user to define these functions will appear as:

```
A     CRT: Baud rate:  9600  Port: 0E8H = 350Q
B     TTY:  Baud rate:  300  Port: 0D0H = 320Q
C     LST:  Baud rate: 4800  Port: 0E0H = 340Q
D     UL1:  Baud rate:  300  Port: 0D8H = 330Q
E     UP1:  Baud rate:  300  Port: 0D8H = 330Q

F     Force output to upper case on CRT: TRUE
G     Force output to upper case on TTY: FALSE
H     Force output to upper case on LST: FALSE

I     Nulls outputted after CR on CRT: 0
J     Nulls outputted after CR on TTY: 0
K     Nulls outputted after CR on LST: 0

L     Echo on DELETE:  TRUE

M     Printer Ready Signal Polarity <HIGH,LOW>: LOW
N     Printer Ready Signal <DTR (Pin 20),RTS (Pin 4)>: RTS

Y     Finished, make changes and return to main menu
Z     Quit, make no changes and return to main menu

Selection:
```

Options "A" through "E" will prompt for baud rate and port number. CONFIGUR will complete the baud rate input as soon as enough characters are input for it to determine if it is a valid baud rate. Valid baud rates are: 38400, 19200, 9600, 4800, 2400, 1800, 1200, 600, 300, 150, 134, 110, and 75.

For example, if C were typed, the terminal would show:

```
LST   Baud Rate:
```

Typing 12 would extend the line to appear as:

```
LST   Baud Rate: 1200  Port:
```

Typing 0E0 as a response for the port number would cause the prompt line to appear like this:

```
LST   Baud Rate: 4800  Port: 0E0
```

After the port number to this prompt line has been entered, configure would return to the sub-menu. That sub-menu would then display the new values.

NOTE: This option changes the baud rate at which computer expects to receive data from a given device, it does not change the baud rate of the device. If the baud rate of the CRT is to be changed, first make the desired change in CONFIGUR. Then physically change the baud rate of the CRT to match the selection made, after you exit from CONFIGUR. If the CRT is changed first, you will be unable to communicate with the configuration program, and unable to complete the operations.

The port assignment may be input in either hexadecimal (base 16) or octal (base 8). The "H" or "Q" (Zenith Data Systems uses the letter "Q" for notating Octal because of the narrow distinction between the character for a letter "O" and the character for numeral zero) radix suffix is not required as input. The valid port numbers are: 320Q (0D0H), 330Q (0D8H), 340Q (0E0H), and 350Q (0E8H). See the above example for port number configuration.

Options "F" through "H" will not prompt for input. The TRUE/FALSE values will be toggled to the alternate value when the option is selected.

Options "I" through "K" prompt for the number of "nulls" required after a carriage return (shown on the menu as "CR") is sent to the device. The values 0 through 7 are valid for this prompt.

Option "L" allows the user to decide whether or not a character erased by using the Delete key is echoed back to the terminal or if it is removed from the video screen by backspacing over it. Normally this value should be TRUE for hardcopy (printing) and FALSE for video display (CRT) terminals. The TRUE/FALSE value will be toggled when this option is selected. This option's value automatically becomes TRUE each time MOVCPMnn and SYSGEN are run.

Options "M" and "N" allow the user to determine the nature of the Printer Ready Signal and which pin of the RS-232C line connector is to be used for that signal. When these options are selected, the alternate value is toggled in automatically by the program.

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Section Five: Disk Parameters Sub-Menu

The Disk Parameters Sub-Menu allows the options of enabling (or disabling) the detailed, disk error messages after a hard (non-recoverable) error. Also, the user may select for either hard-sectored or soft-sectored 5.25-inch disks (provided that the user has the appropriate controller to back the selection). An option is also available for setting the step rates of the associated 5.25-inch disks. The step rate is the length of time used by the drive to position the read/write head from one track to the next, moving either direction.

The 5.25-inch, hard-sectored, drives (those utilizing the H17 controller) used in Heath/Zenith equipment are designed to operate at a 30 mS step rate. These drives may be set at multiples of 2 mS interval between 6 and 30 mS. It is recommended that the step rate be set at 30 mS for most work. See "Step-Rate Error Checking", below, before changing the step rates.

The 5.25-inch, soft-sectored, drives (those utilizing the H37 controller) are recommended to operate at 6 mS for 96 tpi (tracks/inch) density and at 30 mS for 48 tpi. These drives may be set at 30, 20, 12, or 6 mS step rates. More information is contained in the manual that accompanied the drives. See "Step-Rate Error Checking", below, before changing the step rates.

> NOTE: The step rates for 8-inch disk drives or the Winchester Disk System are not adjustable.

Step-Rate Error Checking:

Occasionally, some performance improvement may be obtained by decreasing the step rate of the drives (i.e., decreasing the track-to-track travel time) without increasing the error rate. Caution should be used in selecting the step rate for other than the recommended rate. If the step rate is adjusted too low, the system may not operate at all, or may require numerous attempts to read from or write to the disks. If an error is encountered in reading a sector, CP/M tries to read it again and again until it either reads the sector correctly (which is considered a "soft error") or reports an error when ten unsuccessful attempts to read have been made (which is called a "hard error"). CP/M keeps track of the number of soft errors that occur. (See Appendix D on page 127 for explanation of disk error messages.)

To check the current disk error rate, use DDT (Digital Research's Dynamic Debugging Tool) to examine the value of "SECNTnn" (see: Chapter Eight for the location of this value) in the BIOS tables. Do this after the system has been running for a while because SECNT is set to zero (0) at each cold boot.

SECNT represents the number of soft (recoverable) errors that have occurred in read/write operations with the disk. This value needs to be maintained at a relatively low level, and should not increase unreasonably in the period of one hour. If the value becomes too large, the step rate interval should be increased so that the read/write head is allowed additional time to reach the required track.

The disk parameter options which appear on your terminal may be different than shown in the example below:

```
      A     5.25 Inch Soft Sectored Unit 0 **undefined**
      B     5.25 Inch Soft Sectored Unit 1 **undefined**
      C     5.25 Inch Soft Sectored Unit 2 **undefined**

      D     5.25 Inch Hard Sectored Unit 0 Step Rate: 30 ms
      E     5.25 Inch Hard Sectored Unit 1 Step Rate: 30 ms
      F     5.25 Inch Hard Sectored Unit 2 Step Rate: 30 ms

      G     Detailed Disk Error Message:  FALSE

      Y     Finished,make changes and return to main menu
      Z     Quit, make no changes and return to main menu

Selection:
```

Options "A" through "C" will prompt for the step rates for soft-sectored disk drives and for either 48 or 96 tpi (tracks per inch). Valid step rates are 30, 20, 12, and 6 mS. If during the initial hardware exploration some of these disks are not found, the corresponding unit will be displayed as "**undefined**".

Options "D" through "F" will prompt for the step rates for hard-sectored disk drives. Valid rates are from 6 to 30 mS in increments of 2 mS. If these units are not found, the value will display as "**undefined**".

Option "G" does not prompt for a value. When selected, it will automatically toggle the value to its opposite. If TRUE is shown prior to selection, FALSE will be substituted when that selection is made. For a complete listing of the detailed error messages, see Appendix D on page 127.

Section Six: Default I/O Configuration Sub-Menu

The standard BIOS will also support the CP/M IOBYTE for logical to physical device mapping, as described in the CP/M alteration guide. In the standard configuration, the devices supported are:

CRT:	The System Terminal.
TTY:	An ASCII terminal without handshaking.
BAT:	A batch pseudo-device that uses the reader (RDR:) logical device for input and the list (LST:) logical device for output.
UC1:	A pseudo-device that uses the console logical device for input, and the list logical device device for output.
LPT:	A Heath WH-14 or WH-24 (TI810). A printer with hardware handshaking.
UL1:	A Heath WH-44 (Diablo 1640 or Diablo 630) used as a lineprinter with ETX/ACK protocol.
PTR:	Null source, not implemented. Returns an End-of-File when accessed.
UR1:	Configured for MODEM input.
UR2:	Same as CRT:
PTP:	Null sink, not implemented.
UP1:	Configured for MODEM output.
UP2:	Same as CRT:

The default IOBYTE sets the logical device assignments at cold boot time. This is used to control such things as where the console is and what type of line printer is in general use.

The I/O Configuration menu will appear on the console as:

```
    A     CON: = CRT:  Available TTY: CRT: BAT: UC1:
    B     RDR: = UR1:  Available TTY: PTR: UR1: UR2:
    C     PUN: = UP1:  Available TTY: PTP: UP1: UP2:
    D     LST: = LPT:  Available TTY: CRT: LPT: UL1:

    Y     Finished, make changes and return to main menu
    Z     Quit, make no changes and return to main menu

 Selection:
```

The menu shows the current logical to physical device mappings. Immediately to the right of the current settings are lists of options that are available for selection.

Options "A" through "D" will prompt you to input one of the available physical device designators. After selecting A, B, C, or D, from this sub-menu, the monitor will display the appropriate prompt. For example, if D is selected, the program would display:

```
LST: =
```

When the three letters of the physical device are input in response to the logical device prompt (LST: being the logical device),

```
LST: = TTY
```

the program returns automatically to the sub-menu and displays the new value of the logical device that was selected for alteration.

> NOTE: The colon, ":", is not necessary as input to this prompt, nor is a carriage return.

Section Seven: Automatic Program Control Sub-Menu

The automatic program control menu allows you to specify the execution of a command or program immediately after either a cold or warm boot or both. For this option to function properly, it is necessary that you insert the command or program name in the automatic command line. This is done by choosing option "C" on the sub-menu.

For example the program control sub-menu might appear as:

```
A     Run automatic command line on Cold Boot: True
B     Run automatic command line on Warm Boot: False
C     Automatic command line: CONFIGUR

Y     Finished,make changes and return to main menu.
Z     Quit, make no changes and return to main menu.

Selection:
```

The "A" and "B" options will toggle the TRUE/FALSE value for the automatic program execution on cold and warm boot. The "C" selection will ask for a command line to be input by the user, and then it will enter that automatic command line in the redisplayed menu.

This option can be used to automatically load BASIC or some other program each time the computer is booted. As an example, the following is how you would configure a disk to automatically run the BASIC program "Adventure" each time the disk was booted.

1--From the main menu type D to get to the Automatic Program Control Sub-Menu.

The menu will be displayed as is shown above.

2--In response to the program's prompt, "Selection:", type C. Shown here:

```
Selection:C
```

"Automatic Command Line:" will then be displayed.

3--In response to this prompt, type **BASIC ADVENTURE**:

```
Automatic Command Line:BASIC ADVENTURE
```

4--Press **RETURN**.

"BASIC ADVENTURE" will now appear in the menu and the program will wait for another selection.

5--This time, type **Y**.

The program will incorporate the two changes and redisplay the main menu.

6--To exit the main menu, type **Y**.

This will make the changes to memory and will also write them to the disk, then returning you to the CP/M command mode.

From now on, each time that a cold boot is performed on this disk the automatic program feature will load BASIC, then load "ADVENTURE.BAS", and then execute the program.

> NOTE: Both BASIC and ADVENTURE.BAS must be present on the disk or an error message will be displayed.

The disk could also be made to load "BASIC ADVENTURE" whenever a warm boot is performed.

CHAPTER SEVEN: BIOS SYSTEM ORGANIZATION

- **The Heath/Zenith BIOS Loader (BLDR).**
- **Basic Addresses within the Heath/Zenith BIOS.**
- **BIOS Options Listing**
- **The Algorithm for Disk Deblocking.**
- **Disk Formats.**
- **Page Zero and Clock Organization.**

The Heath/Zenith implementation of CP/M includes several features to enhance the flexibility of the standard CP/M system. As new hardware devices are introduced, they will be supported under this operating system. As a result, the BIOS (Basic Input Output System) is larger than the amount of space provided for that purpose by Digital Research.

Therefore, Heath/Zenith has designed a program to fit where the BIOS is normally recorded on the system tracks. This program is capable of using the CP/M file system to open a disk file and read in the complete BIOS. It is referred to as the BIOS Loader, and contains just enough intelligence to read from the disk and do some simple terminal I/O in case of an error.

When the system is cold booted, the monitor ROM reads the first sectors of the disk in the selected drive into memory and then control is transferred to that program. The cold start loader contained in the first half of those sectors reads the contents of the first tracks into memory at the appropriate locations for the configured memory size. When that is complete, control is passed to the cold boot entry point of the newly loaded system.

Section One: The Heath/Zenith BIOS Loader

With the Heath/Zenith CP/M, instead of being the standard BIOS that is loaded initially, the BIOS loader (BLDR) is loaded and executed. This BLDR opens the file named BIOS.SYS and reads it into the appropriate locations in memory.

By using the BLDR concept, the Heath/Zenith implementation overcomes the size limitation imposed by the Digital Research design and at the same time simplifies the otherwise error-prone process of integrating one's own modified BIOS into the system. The penalties paid are slight--the disk from which you cold boot must contain the BIOS.SYS file, and it takes somewhat longer to cold boot because the BIOS file must be opened, read and relocated in memory.

Note that the BIOS.SYS file is only referenced during the cold boot process, so it only needs to be on the disk used to cold boot your system. The warm boot function of CP/M does not re-read the BIOS, and therefore this file does not necessarily have to appear on disks that are used during a warm boot.

The BIOS.SYS file contains the BIOS in a relocatable file format that is compatible with the page relocatable format used in Digital Research's MP/M operating system. This relocatable format is reasonably compact, and storing the BIOS in relocatable form provides the advantage of not requiring relocation of the BIOS during MOVCPMnn.

Section Two: Basic Addresses in the BIOS

The Heath/Zenith BIOS implementation is structured so that system utilities can readily access its device tables. This is primarily a requirement of CONFIGUR, which alters some of the values which are used at run-time. Many of these values would be assembly-time constants in the normal implementation of CP/M.

A user program can find the BIOS by using the address at location 0001H as a pointer (the operand of the jmp wboot instruction). That value will be 3 greater than the address of the start of the BIOS.

The first part of the BIOS is the standard Digital Research entry point "jump" table. This table include jump instructions to each of the 17 entry points into the BIOS.

The "listst" entry point for checking the output status of the list device is implemented in this release. This entry point is used by some background printing spoolers.

Immediately following the standard entries is a one byte BIOS version number (in binary). It is important that programs which alter values in the BIOS in a direct way know exactly which version they are dealing with. For example, CONFIGUR must patch tables at the beginning of the BIOS and therefore needs to be reasonably certain that those tables are where it expects to find them.

Upon cold boot, CP/M will print the version number as part of the sign-on in a message like:

```
32K Heath/Zenith CP/M 2.2.03
```

where "03" is the version number.

The next byte is used as a mode byte for the BIOS. At the moment six of the bits are assigned; the remainder are reserved. Bit 7 causes the CCP to attempt to execute the automatic command line on the default disk every time the disk is cold booted. Bit 6 performs the same function for each warm boot. Bit 3 contains the Printer Ready flag, 0=low and 1=high. Bit 2 supports the partitioning of the Z67 Winchester Disk. Bit 1 enables the printing of disk error messages by the BIOS so the user will receive extended, error-status messages. Bit 0 is set when the BIOS is configured for use with a H8-5 serial card for the console port.

The next series of bytes are used as serial device control structures. These specify the port number, baud rate, number of nulls required after a carriage return, and upper case mapping flag for each of the serial I/O devices. The data is arranged as port number, followed by the baud rate divisor word.

The high order nibble of the baud rate divisor forces all output to upper case if the MSB is 1, and the least significant 3 bits of that nibble are the number of nulls sent after a carriage return to that device. There is one of these structures for each of 5 devices (although only 4 are currently used). In order, these are: CRT, TTY, LPT, RDR/PUN, and reserved.

Then two words (four bytes) are used as a soft error counter for the 5.25-inch disk drives. These words are incremented after each soft (recoverable) error. By using DDT to examine this value you can get an indication of the performance of your disk system.

The next byte is set for the maximum number of disks that this BIOS may be configured for. This allows programs to determine the length of the disk tables and to access only those tables that really exist.

This is followed by the disk parameter base and the disk parameter entries for each of the disk drives. In addition to the 16 bytes per disk assigned by Digital Research, the Heath/Zenith implementation has added 8 bytes to each entry.

The first of these 8 is a multi-purpose byte that is used to identify the drive type and its port address. The three most significant bits indicate the drive type. The second byte is the select code necessary for this drive. The next byte is the number of 128 byte records per physical sector. It is followed by a byte indicating the number of 128 byte records per allocation unit. The next four bytes are used for all drive controllers except the H/Z47.

For the 5.25-inch disk drives the first of these indicates the current track position of the head for this drive. The next byte controls the step rate. When set, the most significant bit of that byte indicates that the drive will be up to speed in 250 mS instead of the normal 1000 mS. The next byte contains flags. The last byte is reserved for use during the physical to logical drive mapping process.

For the Z67, these bytes are used a bit differently. The first word (two bytes) is the logical sector number of track 0 in a partition. The last word is the logical sector number used in upper bound-limit checks.

In addition to these tables, it is necessary for some system utilities to have access to some of the values used for disk control. These values have been located in BIOS and in page 0 of memory. These values control the motor and select time-outs as well as the head settle and write-gate step delays.

At 000DH the current value of the H/Z89 control latch at port 362Q is stored. This port controls the presence of RAM at zero and enables/resets the clock. In the H8, the clock enable and RAM at zero are split between two different ports.

The H/Z89 contains special hardware that traps input and output instructions to some of the H8 control ports and generates a nonmaskable interrupt (NMI). Since the Z80 NMI vector falls within the RAM allocated for the default file control block (FCB), it is not possible to guard it with a return instruction or to install a jump to a user routine. Therefore, care must be taken that no inputs or outputs to the H8 control ports (360Q, 361Q, 372Q, 373Q) are attempted in the H/Z89. Location 000EH is used for the value required to reset the clock on the H8, or 0 if on an H/Z89. Location 000FH is reserved for the contents of the H17/H77/Z87 control port. The 16 bytes located at 0040-004FH are reserved.

An effort will be made to keep these values in their same relative positions. However, it is quite possible that between this release and future releases of CP/M from Heath/Zenith there will need to be some redefinition of the BIOS structure. There is a diminishing probability of change with each release thereafter. Software that accesses these tables should be written using an easily redefinable template to simplify adaptation to such changes.

BIOS Options:

When CP/M is cold booted, the system generates the message:

```
32K Heath/Zenith CP/M 2.2.03
FOR{type} DISKS WITH OPTION(S){code}
```

The "code" will show the options that are currently selected active within the BIOS.

The list of options are as follows:

P	The Z67 is Partitioned
P2	BIOS supports two Z67 Partitions
I	CRT Input is Interrupt Driven
B	CRT "BREAK" key's Interrupt is available (causes an immediate warm boot)
E3	BIOS supports Extended Double Density on Z37 Disk Drive
E4	BIOS supports Extended Double Density on H/Z47 Disk Drive
T	Time of Day Clock
E	Event Counter

Section Three: Disk Deblocking

The Heath/Zenith BIOS uses a deblocking algorithm which transparently converts the sectors stored on the 5.25-inch, the 8-inch disks, and on the Winchester Disk to the 128 byte logical records used by CP/M. The BIOS uses information provided by the BDOS to minimize the number of physical read and write operations.

When accessing the disk, the deblocker keeps track of the logical records that are currently buffered within the BIOS. If the BIOS is processing a read call, it is possible for it to retrieve the information from its buffers without any disk activity if the proper sector is already in memory as a by-product of a previous operation.

The buffering that occurs during the write operation means that records can be buffered in memory until the next disk operation. The buffer is only written to the disk if the calling program accesses a logical record that is not contained in the current physical sector, the buffer overflows, or the write is flagged as a "directory access."

One important ramification of this "write-behind" is that programs that do direct BIOS calls to perform track/sector disk I/O should make certain that the write buffer is emptied before the disk is removed or changed, or a cold or warm boot is performed. This can be done by specifying that the last write operation should be performed immediately without "write-behind" as the BDOS does when it accesses the disk directory. See the CP/M 2.0 Alteration Guide, pages 34 and 35.

Section Four: Disk Format

5.25-Inch Hard-Sector Disk Format

The logical records are numbered from 1 to 20 on each track, and are stored in physical sectors 0 thru 9. The tracks of the disk are numbered 0 to 39. The CP/M system reserves the first three tracks for the Cold Start Loader, the CCP, the BDOS, and the BIOS Loader. The CP/M directory begins on track 3, and the usable space begins immediately following it.

8-Inch and 5.25-Inch Soft-Sector Disk Formats

The Heath/Zenith implementation of the BIOS transparently supports a mixture of single, double, and extended double density disks. In addition, each of the densities can be recorded on either single or double-sided media. The first time a disk is "logged-on" after a disk reset function (such as a warm boot), the density and whether the disk is double or single sided is checked and used to dynamically modify the disk parameter tables for the particular drive. The most important ramification of this is that disks of different densities or number of recordable sides should be "logged-on" after being interchanged.

The Heath/Zenith configuration offers the user three densities available on the 8-inch disk. Single density is comprised of 26 sectors per track with 128 bytes per sector. Double density contains 26 sectors per track with 256 bytes per sector. Extended density uses 8 sectors per track with 1024 bytes per sector. Deblocking is used on double and extended densities to make each track appear to have 52 and 64 sectors respectively.

The 5.25-inch soft-sectored disks have two possible densities. Single density offers 10 sectors per track with 256 bytes per sector. Double density has 16 sectors of 256 bytes each per track.

Section Five: Page 0 and Clock Organization

(also see "CP/M 2.0 Alteration Guide" pages 23-24)

```
0000H                 jmp   BIOS+3          ;wboot entry use value
                                            ; at 0001H as a pointer
                                            ; to the BIOS to access
                                            ; jump vectors and tables
0003H                 db    IOBYTE          ;current IOBYTE
0004H                 db    DEFAULT$DISK    ;current default disk
0005H                 jmp   BDOS+6          ;BDOS entry point use value
                                            ; at 0006H to find the top
                                            ; of user memory (subtract
                                            ; CCP size if it is to be
                                            ; preserved)
0008H                 jmp   clock           ;clock interrupt service
                                            ; vector
                      dw    TICCNT          ;1 work counter incremented
                                            ; every 2 mS interrupts are
                                            ; enabled and clock is on
000DH                 db    H88CTL          ;current contents of H88/Z89
                                            ; control latch (362Q)
000EH                 db    H8CTL           ;current contents of H8
                                            ; control latch (360Q), or
                                            ; zero if on H/Z89
000FH                 db    DEVCTL          ;current contents of H17/H77
                                            ; Z87 control latch (177Q)
0018H                 jmp   CRTINT          ;CRT input interrupt service
                                            ; vector
0020H                 jmp   H37INT          ;H37 interrupt service vector
0023H     dlymo37     db    0               ;H37 motor turn-off delay
                                            ; counter
0024H     dlyh37      db    0               ;H37 deselect delay counter
0025H     h37ctl      db    0               ;H37 control register image
0026H     h37iret     dw    0               ;where to go after H37
                                            ; interrupt
                                            ;
;using the value at location 0009H as a pointer to the clock routine,
;the disk (H17/H77/Z87) timers can be accessed, they occupy the three
;bytes immediately preceeding the clock interrupt
;
          dlymo:      db    0               ;motor timer decremented
                                            ; every 512 mS until 0
          dlyh:       db    0               ;head load timer decremented
                                            ; every 512 mS until 0
          dlyw:       db    0               ;head settle timer
                                            ; decremented every 4 mS
                                            ; until 0
          clock:      ...                   ;clock interrupt service
                      ...                   ; routine, located in BIOS
                      ei
                      ret
```

Appendix A: Heath/Zenith CP/M 2.2 on a One Drive System

For a large percentage of computer work, at least two disk drives are necessary. It is often convenient, for example, to have the input files to a program on one disk and the output on another. The system files or the utilities also may be segregated from the program disks.

While not as convenient as actually having more physical drives, the Heath/Zenith BIOS implementation does permit the one or two drive owner some of the advantages of having three separate drives. Regardless of how many physical drives are connected to the system, the BIOS creates three "logical" disk drives. If you have three physical drives, the mapping is the obvious, direct one. For one and two drive systems, all nonexistent physical drives are mapped onto an existent drive which is the drive in the front panel of the H/Z89, or the left hand drive of an H/Z17 on an H8 system.

Whenever a nonexistent 5.25-inch drive is referenced, the system will first check to see which disk is currently occupying the mapping unit. If it is the appropriate logical disk, the operation can proceed. If it is not the correct disk for this operation, you will be prompted to put the correct disk in the drive, and to press RETURN, before the disk is accessed. For Example, to TYPE a file named SAMPLE.DOC that resides on imaginary drive B, the procedure would be:

```
A>TYPE B:SAMPLE.DOC

Put disk B in drive A: and press RETURN

<TYPEing of SAMPLE.DOC ...>

A>
```

Note that the default disk is A, and that disk B is mounted in drive B:. Any subsequent operation at this point such as a warm boot, or a simple DIR with no arguments, will cause CP/M to request that disk A be placed back into drive B:.

By keeping track of each of the disks that you are using by mentally assigning them to what would normally be a physical drive, you can access "three" separate drives.

There are only two exceptions to this mapping scheme: DUP and FORMAT. Because of the way that these programs must interact with the hardware, they do not support the logical to physical mapping.

The FORMAT utility can only be used to format a disk on a drive that actually exists. You have at least one drive, namely drive A in your system. When you run the FORMAT utility, answer the prompt

```
Which drive do you wish to use for this operation? (A thru F):
```

With "A".

The DUP utility can only copy or verify disks that are mounted in physically separate drives. If you wish to perform an exact duplication of a disk, including the system, on a one drive system, proceed as follows:

Invoke SYSGEN

```
A>SYSGEN
SYSGEN VER 2.2.nn
SOURCE DRIVE NAME (OR RETURN)
```

Respond with A for the source drive. SYSGEN will proceed to read into memory the system tracks from the disk in drive A. SYSGEN will then prompt with,

```
DESTINATION DRIVE NAME (OR RETURN TO REBOOT).
```

At this point, remove the disk that is in A, and replace it with the disk that you are creating. Answer the prompt with drive B:. You have now duplicated the system tracks on your new disks.

To complete the full duplication of your disk, you will need to run the PIP utility. Mount your original source disk in drive A and type,

```
A>PIP B:=*.*[R]
```

(The 'R' option on the command line will insure that files that are marked with the 'SYS' attribute are also copied). PIP will read into its internal buffers as much of a given file as it can. When its buffers are full, it will attempt to write them to the destination file, which in the above case, resides on drive B. CP/M, knowing that there is no physical drive B, will ask you to,

```
Put disk B in drive A: and press RETURN .
```

When PIP is through writing to B, it will then attempt to read from disk A. CP/M will detect that the wrong disk is mounted in drive A: and respond with,

```
Put disk A in drive A: and press RETURN .
```

This "swapping" of disks will continue until all of the files have been copied. Although the process is tedious, it does perform the desired function.

Appendix B: Heath/Zenith Hardware Configuration

The H/Z89 Computer:

The minimum supportable system that will run under this implementation of CP/M is:

- An H/Z89 computer system with at least 32K of random access read/write memory, the Z89-7 or H88-7 ROM modification kit must be installed (already done on Z89-FA and later models).

- One connected, functional disk drive (the H/Z89 comes with a single drive with a H/Z17 controller).

This implementation of CP/M for the H/Z89 will support the following pieces of hardware:

The Computer:

- An H/Z89 computer system with 32K or more (64K max) of random access read/write memory, the Z89-7 or H88-7 ROM modification kit must be installed (already done on Z89-FA and later models).

Disk Drives:

- From one to three hard-sectored 5.25-inch floppy disk drives (H/Z17 controller).

- From one to three soft-sectored 5.25-inch floppy disk drives (Z37 controller).

- Two 8-inch floppy disk drives (H/Z47 controller).

- One Winchester Disk System (10 MB Winchester Disk and Single 8-inch Floppy Disk; Z67 controller).

With a maximum of six drives connected and functional. (Note that only two types of drives may be connected at any given time.)

Printers:

- A diablo 630, 1610, 1620, 1640, or 1650 (compatible) printer set to 1200 baud, and an RS-232C cable connected to the socket labeled DCE 340-347. The UL1: logical device driver should be connected to this port. It uses an ETX/ACK handshake protocol to control the printer output.

- An H14, WH14, WH24 or H/Z25 dot-matrix printer, utilizing the RTS modem control for handshaking, connected to the socket labeled DCE 340-347. If your printer requires any other handshaking convention (beside those possibilities that may be covered by the Configur utility, on page 99), it will be your responsibility to appropriately modify the BIOS physical device driver. The Heath/Zenith Software Group can not assume the responsibility for any such modifications.

- A WH36, or any printer that does not require "busy" handshaking, may be connected to the TTY: logical device, again it is plugged into the socket labeled DCE 340-347. In the Configuration program, specify the port number for the TTY: as being 340Q and move the LST: device to 320Q. (H/Z89 computers are not currently supplied with port 320Q populated, it is made up of the empty set of sockets on the serial interface card.)

- A WH13 modem connected to the plug labeled DTE 330-337.

The Heath H8 Computer

The minimum supportable system that will run under this implementation of CP/M is:

- An H8 computer system with at least 32K of random access read/write memory (the HA-8-8 Extended Configuration kit must be installed).
- A terminal connected to the computer with a serial interface at port 350Q (0E8H) on an H8-4 card or port 372Q (0FAH) on an H8-5 card.
- One connected, functional floppy disk drive.

This implementation of CP/M for the H8 will support the following pieces of hardware:

- An H8 computer system with 32K or more (64K max) of random access read/write memory (the HA-8-8 Extended Configuration kit must be installed).
- A terminal connected to the computer with a serial interface at port 350Q (0E8H) on an H8-4 card or port 372Q (0FAH) on an H8-5 card.
- From one to three hard-sectored 5.25-inch floppy disk drives (H17 controller).
- Two 8-inch floppy disk drives (H/Z47 controller)

With a maximum of six drives connected and functional. (Note that only two types of drives may be connected at any given time.)

Printers:

- A Diablo 630, 1610, 1620, 1640, or 1650 (compatible) printer set to 1200 baud, and the RS-232 cable connected to port 340-347 on an H8-4 card. The UL1: logical device driver should be connected to this port. It uses ETX/ACK handshake protocol to control printer output.

- An H14, WH14, WH24 or H/Z25 dot-matrix printer, utilizing the RTS modem control for handshaking, connected to port 340-347 on an H8-4 card.

If your printer requires any other handshaking convention (beside those possibilities that may be covered by the Configur utility, on page 99), it will be your responsibility to appropriately modify the BIOS physical device driver. The Heath/Zenith Software Group can not assume the responsibility for any such modifications.

- A WH36, or any printer that does not require "busy" handshaking, can be connected to the TTY: logical device, again it is plugged into port 340-347 on an 8-4 card. In the Configuration program, specify the number for the TTY: as being 340Q and move the LST: to 320Q.

- A WH13 modem connected to port 330-337 on an H8-4 card.

Appendix C: SW-501 Switch Configuration:

```
7 6 5 4 3 2 1 0

X -------------------------  1=Auto-Boot 0=Not Auto-Boot
  X -----------------------  Baud Rate
    X ---------------------  Memory Test/Normal
      X -------------------  1=Primary (170Q) 0=Secondary (174Q)
        X X ---------------  Device Type (port 170Q)
            X X -----------  Device Type (port 174Q)
```

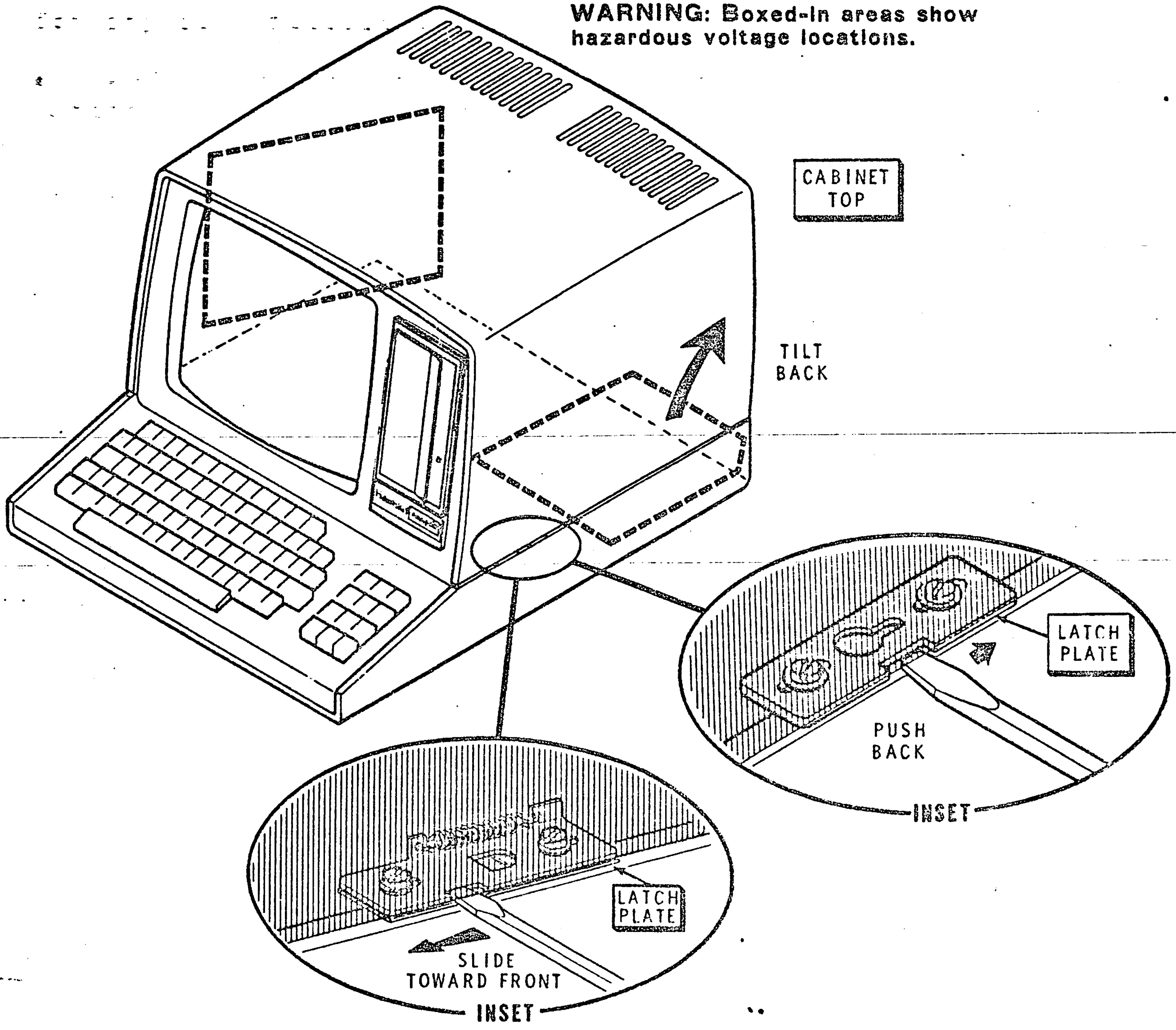

WARNING: Boxed-in areas show hazardous voltage locations.

Figure C-1

Appendix C: SW-501 Switch Configuration

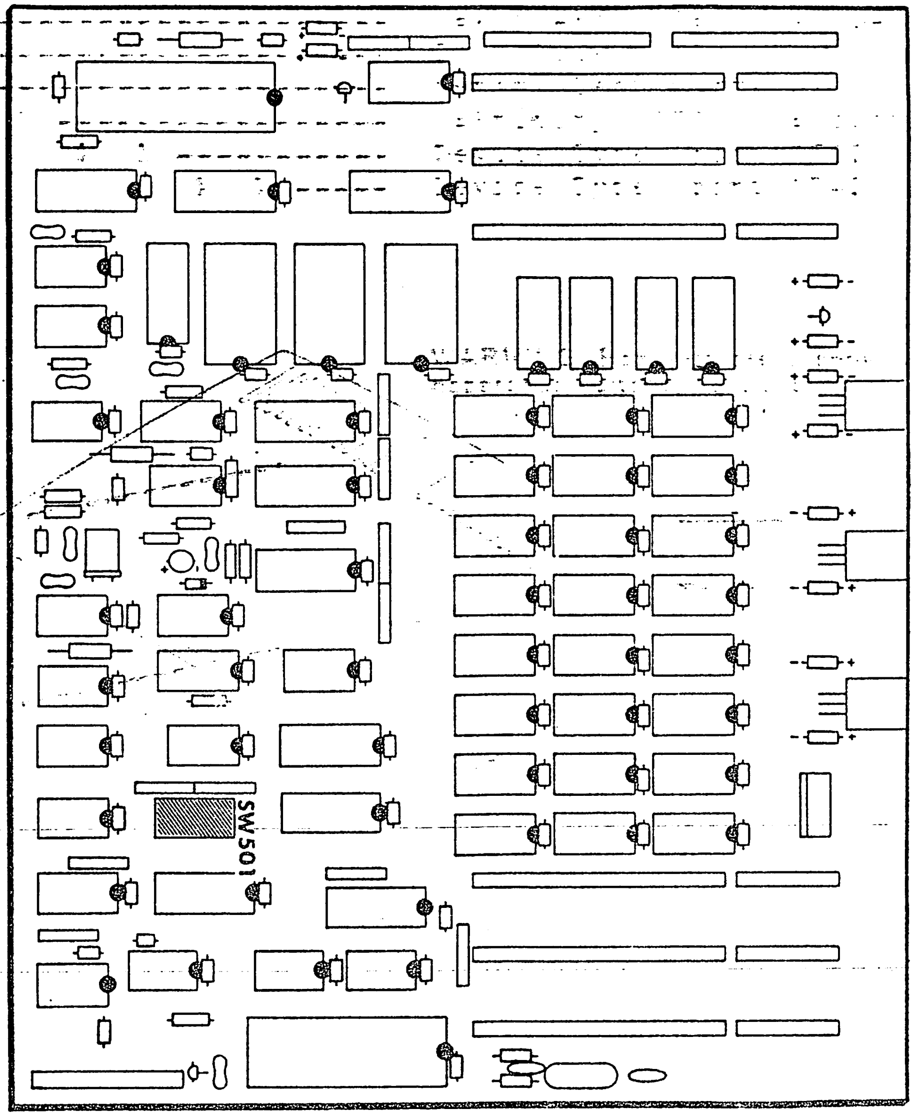


Figure C-2

Appendix D: Expanded Disk Error Messages

When the Heath/Zenith BIOS encounters an error when it tries to read or write to a disk, it will retry the command. Each time a "soft" or recoverable error occurs with a 5.25-inch disk, the appropriate SECNTnn variable located in the BIOS tables is incremented. In the event that the sector still can not be read or written, the error is flagged as "hard" or non-recoverable. The hard error causes the operating system to generate an error message stating that a read or write error has occurred. In addition to that message, the BIOS can be configured to provide an error message that includes an error code describing the type of error that occurred.

These error codes are all two-digit hexadecimal numbers that specify the type of error that has occurred. Each disk controller has its own set of disk error codes. The error code tables for each type of device is found in that device's hardware manual (except for the H/Z17 controller, and four of the Z67 error codes. These codes are listed below).

H/Z17 Error Status Codes:

01--Bad Track Error: most likely an error in the floppy disk mechanism, often caused by CONFIGURing the BIOS drive step time too short.

02--Head Sync Error: an error has occurred in the format of the floppy disk.

04--Header CRC Error: an error in reading the sector identification header, generally caused by defective media.
08--Data CRC Error: an error in reading the data on the sector, can be caused by defective media, power failure or "glitch" during writing, defective hardware.

10--Record Not Found: the specified track and sector can not be located, can be caused by poor alignment, imperfect media, or incorrect disk drive rotational speed, specifying a non-existent track or sector.

20--Missing Data Sync: an error has occurred in the format of the floppy disk.

40--Write Protect Error: an attempt was made to write to a write-protected disk.

80--Unit Not Ready: the drive unit was not ready to read or write data. This can be caused by not having a disk in the drive or leaving the door open.

Z67 Error Status Codes (not in Hardware Manual):

80 through 82--Hardware interface errors.

83--Attempt made to exceed partition boundaries.

Appendix E: Disk Handling and Operation

Disk Handling

Disks are easily damaged. Handle them with care. Observe these precautionary practice:

- Keep the disk in its storage envelope whenever it is not in the Floppy Disk drive.
- Keep the disk away from magnetic fields. Magnetic Fields can distort the recorded data on the disk.
- Replace damaged or worn storage envelopes.
- Write on the plastic jacket only with a felt-tip pen. Do not use a lead pencil or ball-point pen.
- Keep the disk away from hot or contaminating material.
- Do not expose the disk to sunlight.
- Do not touch or clean the surface of the disk. Abrasions can alter stored data.

Disk Loading

Refer to Figure E-1, open the front panel door, and insert the disk, label facing the open door. Then close the door.

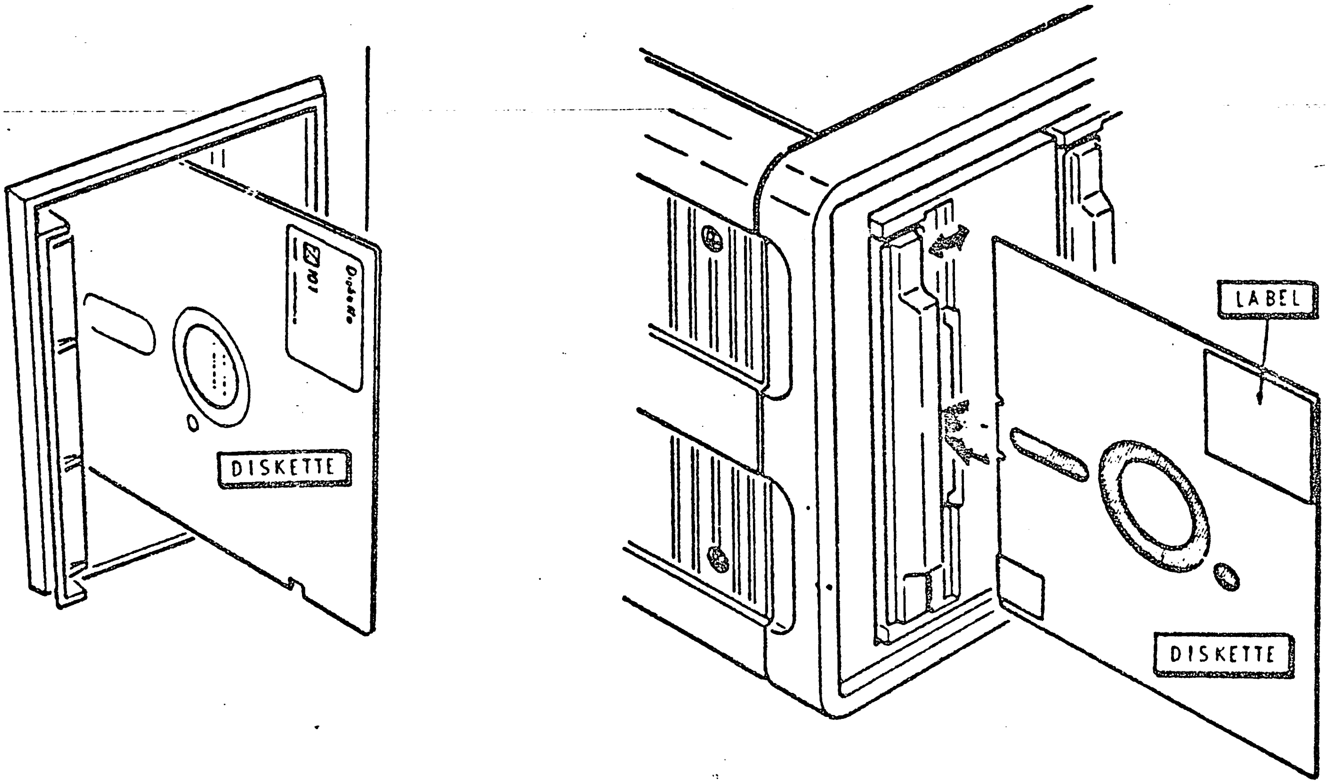
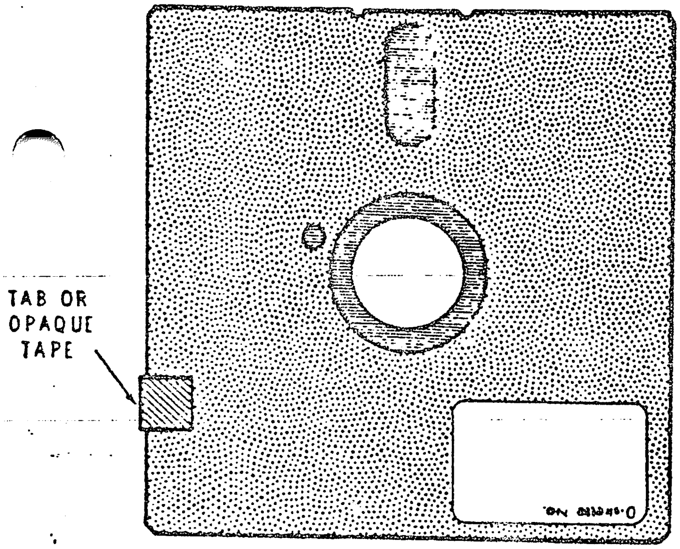


FIGURE E-1

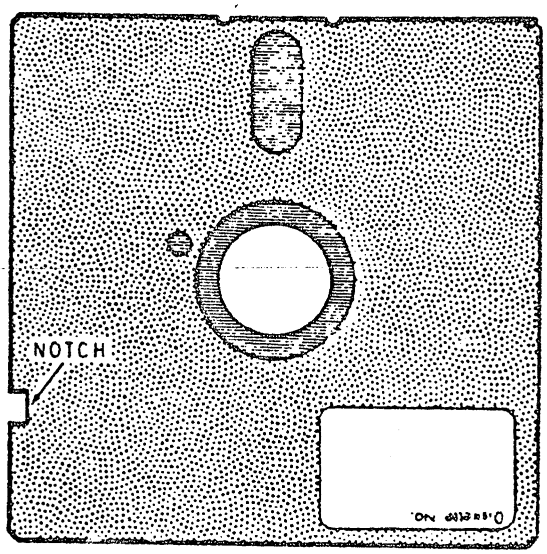
Mechanical Write-Protection

The disk can be write-protected so that it cannot be written on. (All distribution disks are sent write-protected.) Depending on the size of the disk, this is done differently. A 5.25-inch disk has a "write-protect" notch on the side. When the notch is covered with a tab or opaque tape, no data can be written on the disk. Figure E-2 shows a write protected 5.25-inch disk, and Figure E-3 shows one write-enabled.



WRITE PROTECTED

FIGURE E-2



WRITE ENABLED

FIGURE E-3

An 8-inch disk has a "write-enable" notch on the side. If the notch is exposed, no data can be written on the disk. You must cover the notch to allow writing on the disk. Figure E-4 shows a write protected 8-inch disk, and Figure E-5 shows it write enabled.

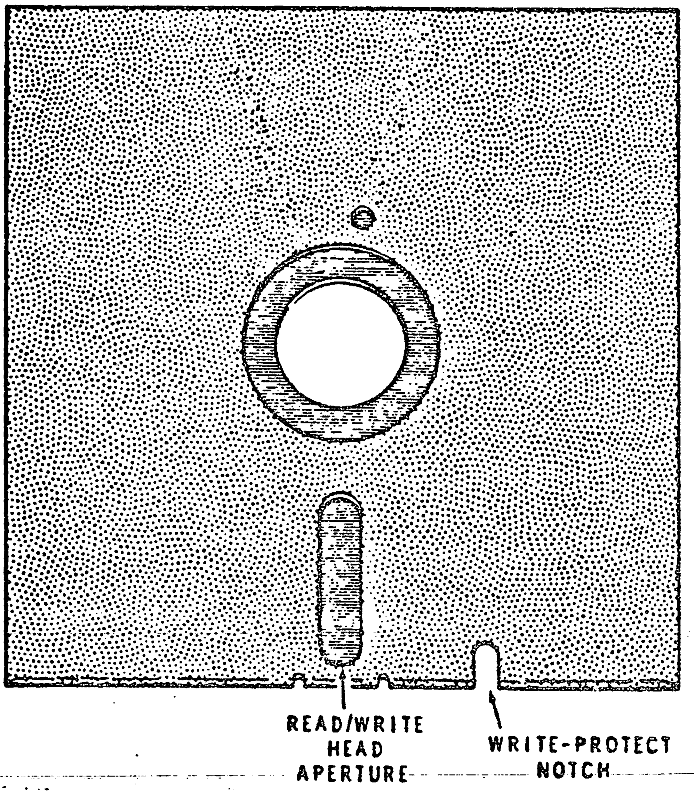


FIGURE E-4

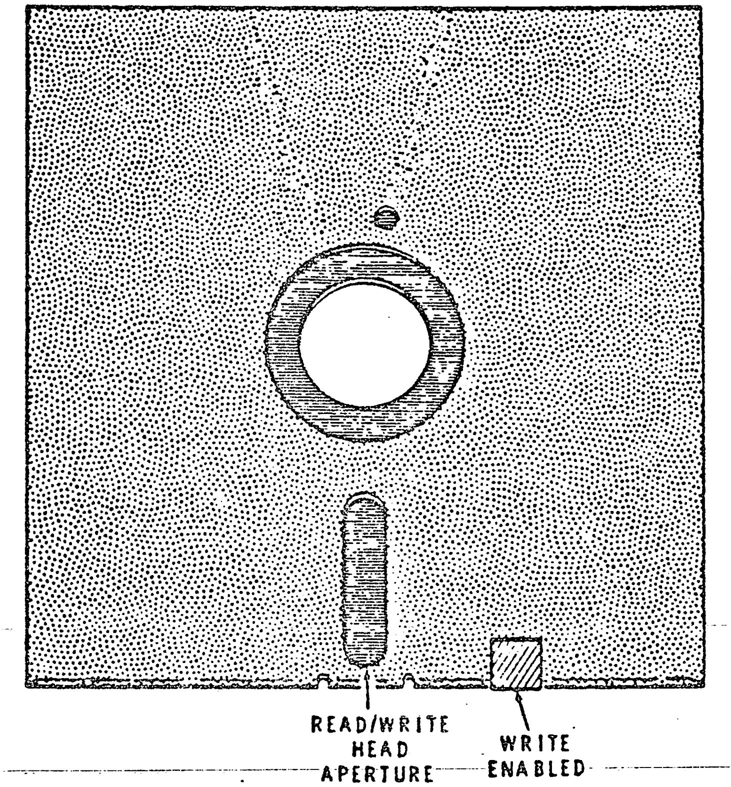
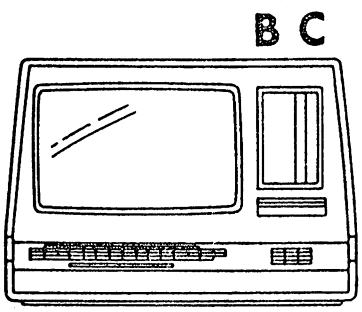


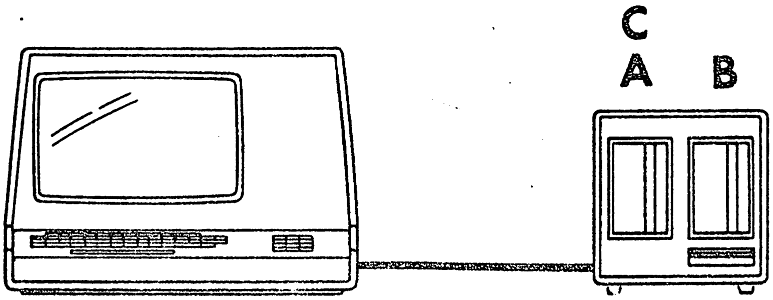
FIGURE E-5

APPENDIX F: DRIVE NAME DETERMINATION

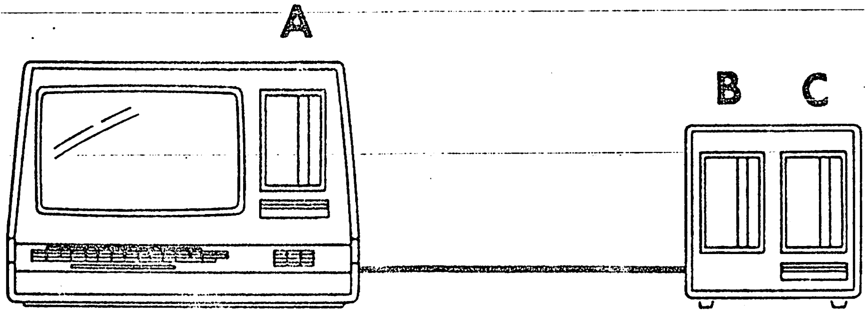
H/Z 17 BOOT DEVICE



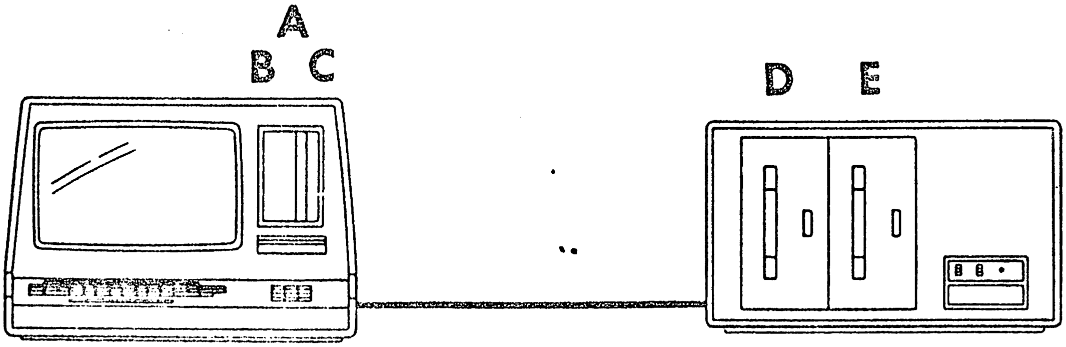
H/Z17 SINGLE DRIVE



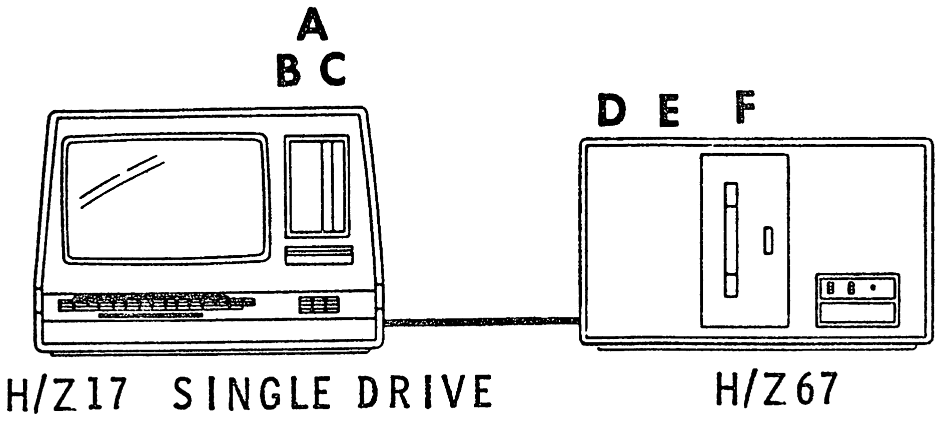
H/Z17

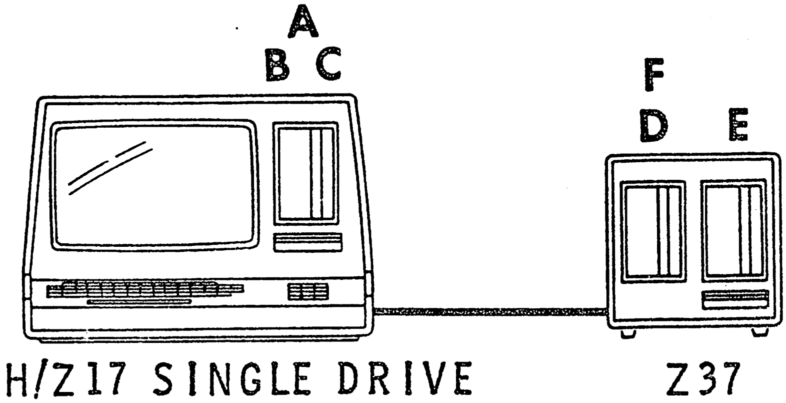


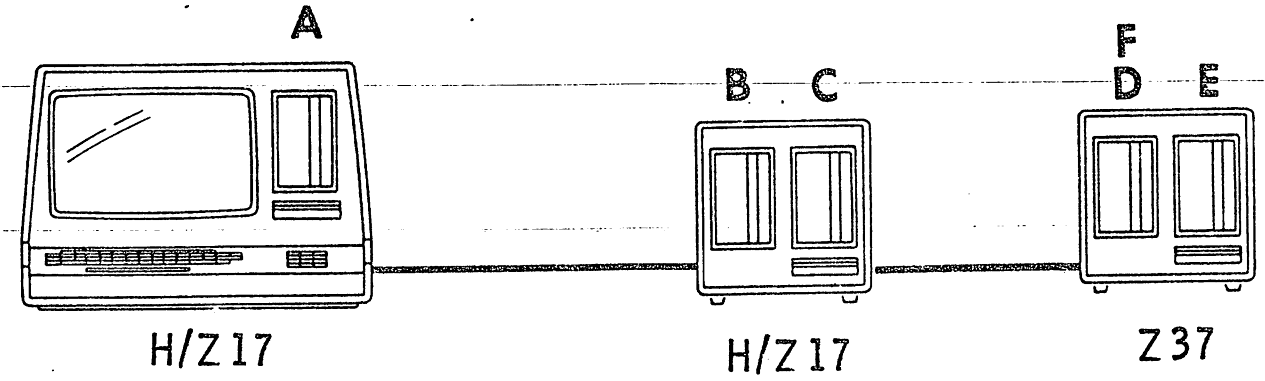
H/Z17 H/Z17

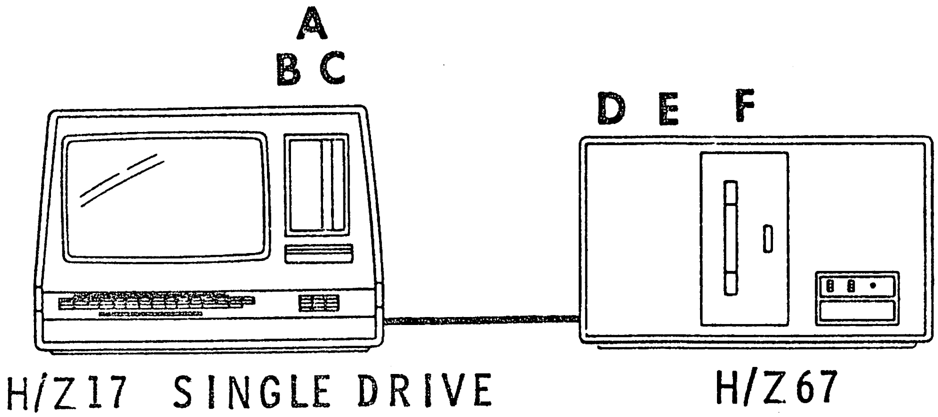


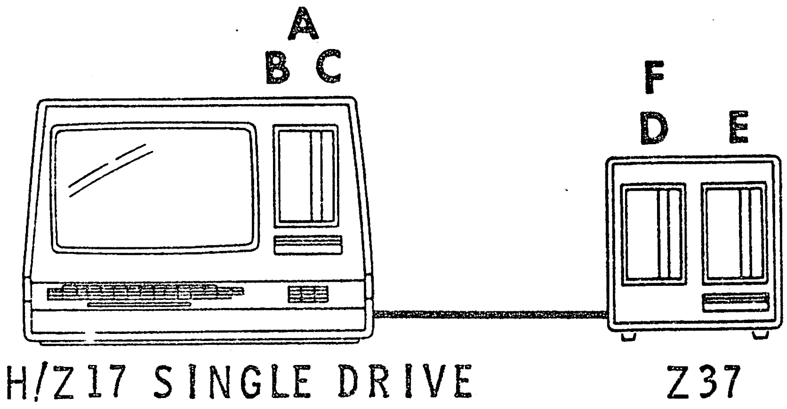
H/Z17 SINGLE DRIVE H/Z47

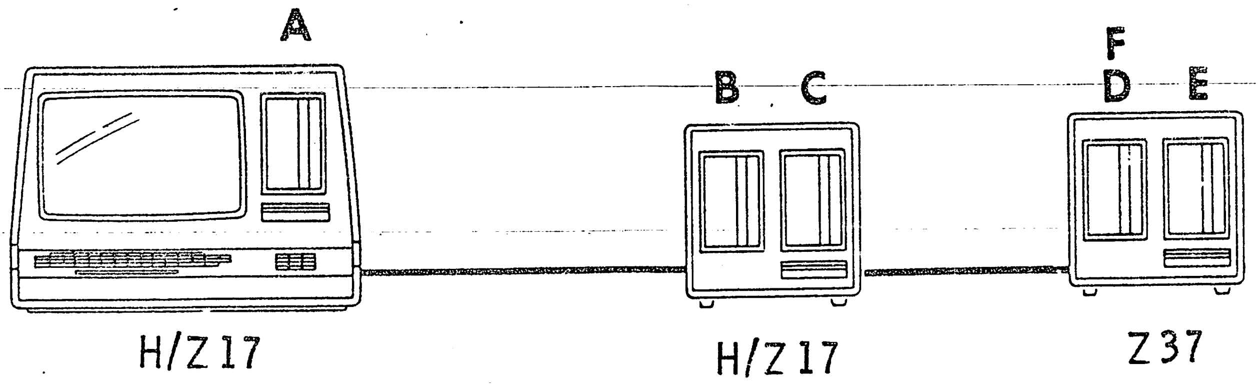

A
B C
D E F
H/Z17 SINGLE DRIVE
H/Z67


A
B C
F
D E
H/Z17 SINGLE DRIVE
Z37

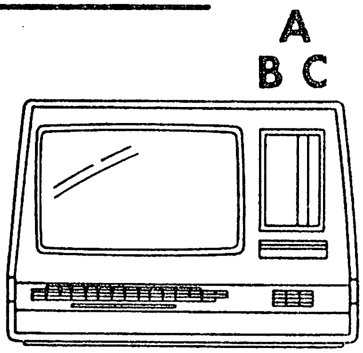

A
B C
F
D E
H/Z17
H/Z17
Z37


A
B C
D E F
H/Z17 SINGLE DRIVE
H/Z67

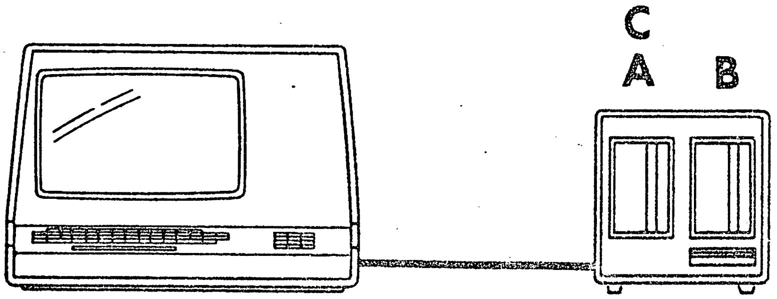

A
B C
F
D E
H/Z17 SINGLE DRIVE
Z37


A
B C
F
D E
H/Z17
H/Z17
Z37

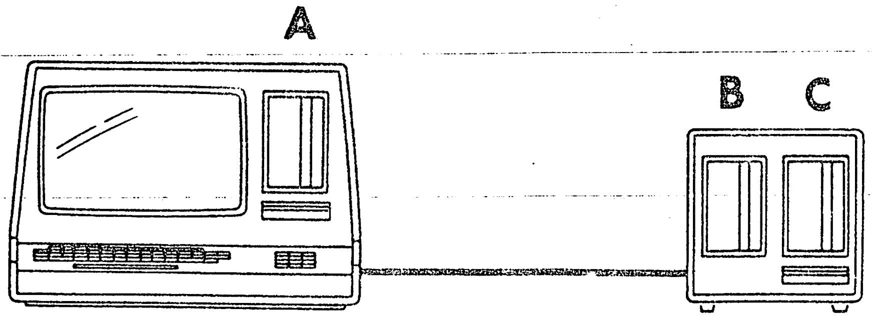
Z37 BOOT DEVICE



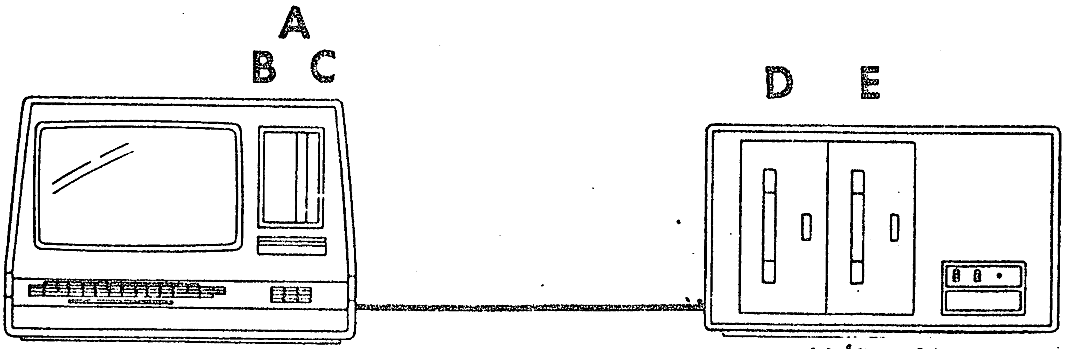
Z37 SINGLE DRIVE



Z37

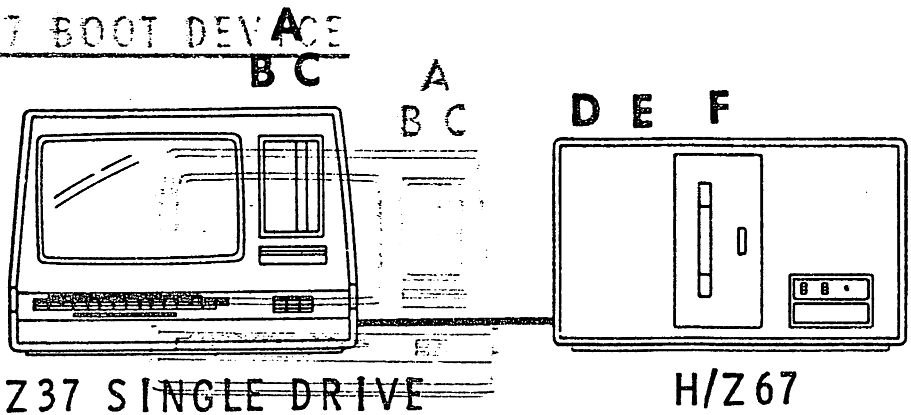


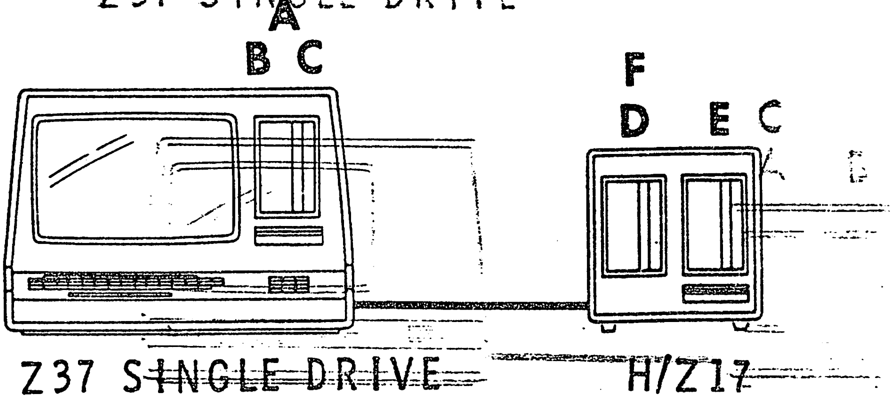
Z37 Z37

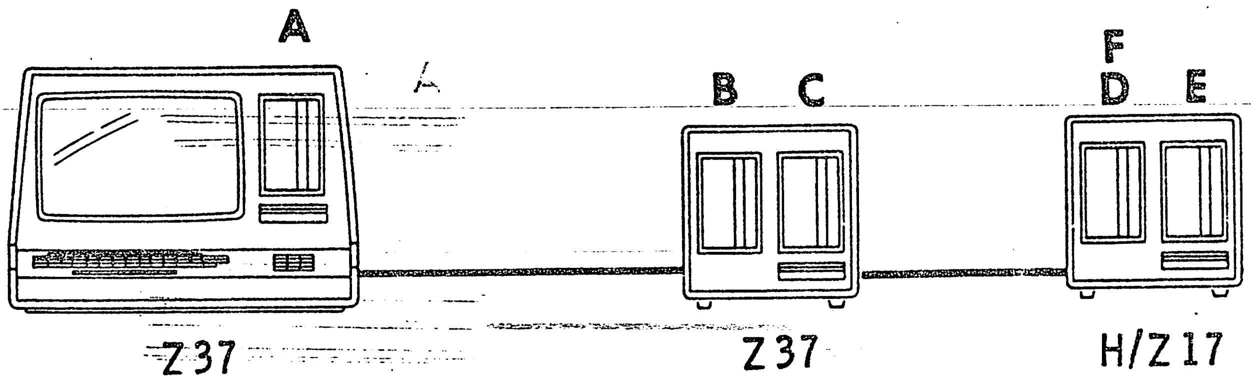


Z37 SINGLE DRIVE H/Z 47

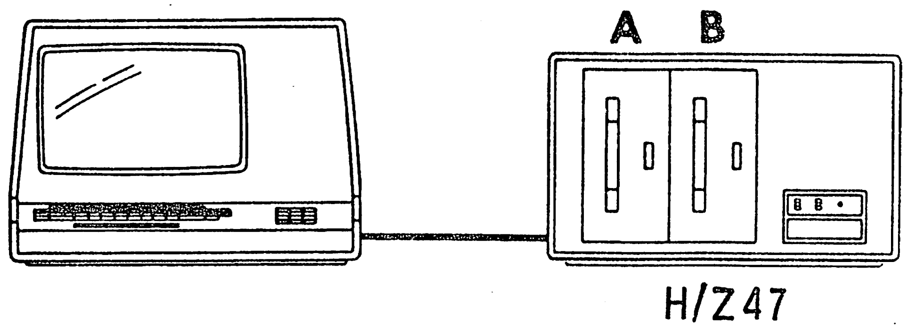
Z37 BOOT DEVICE

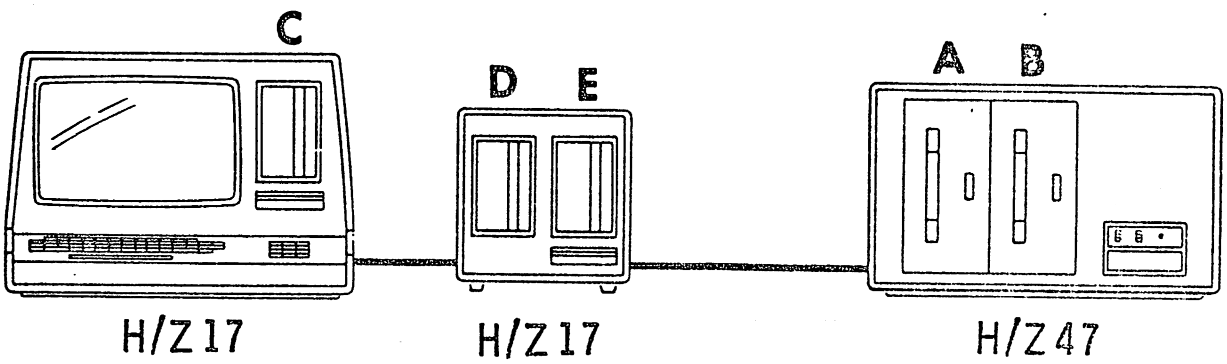


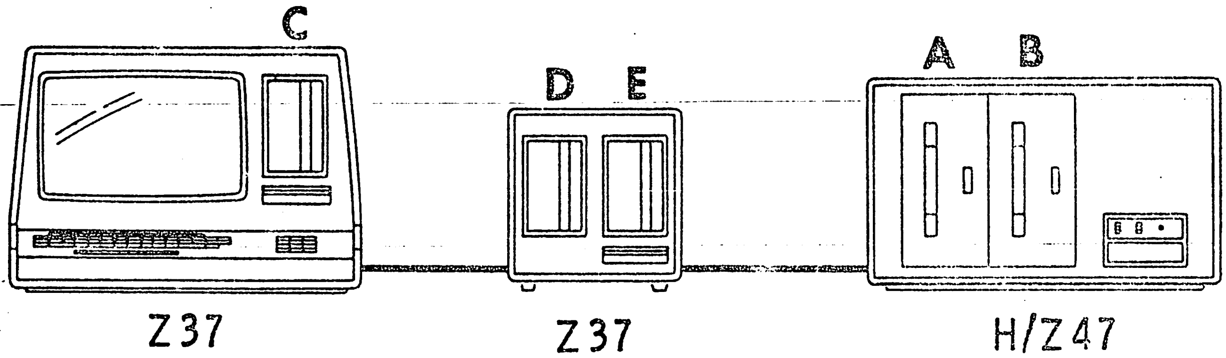


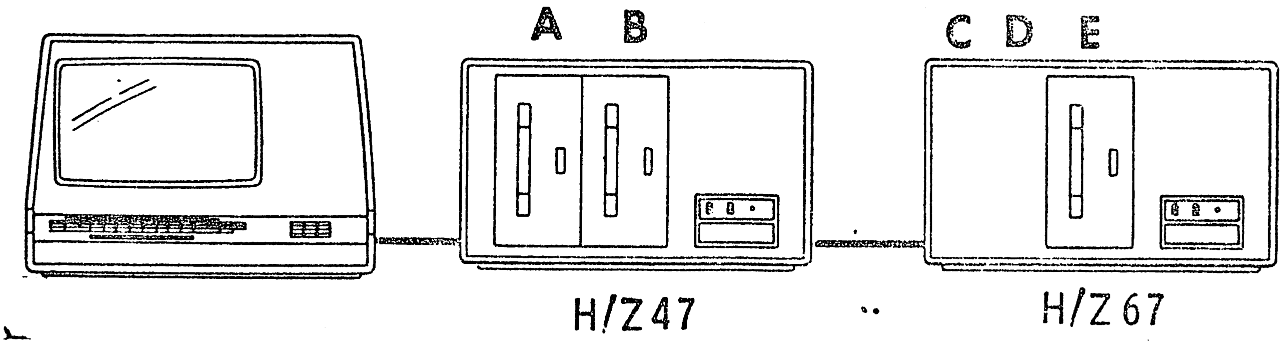


H/Z47 BOOT DEVICE

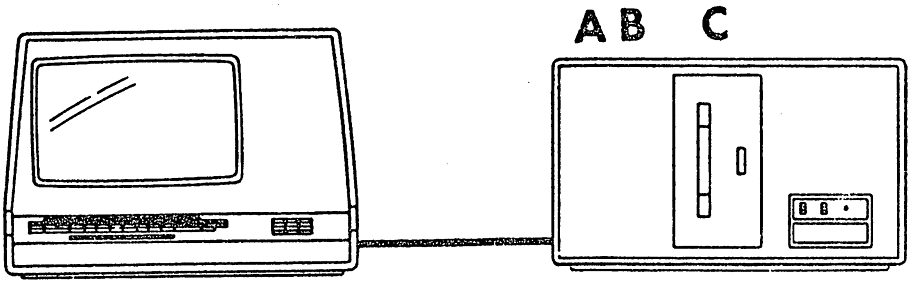




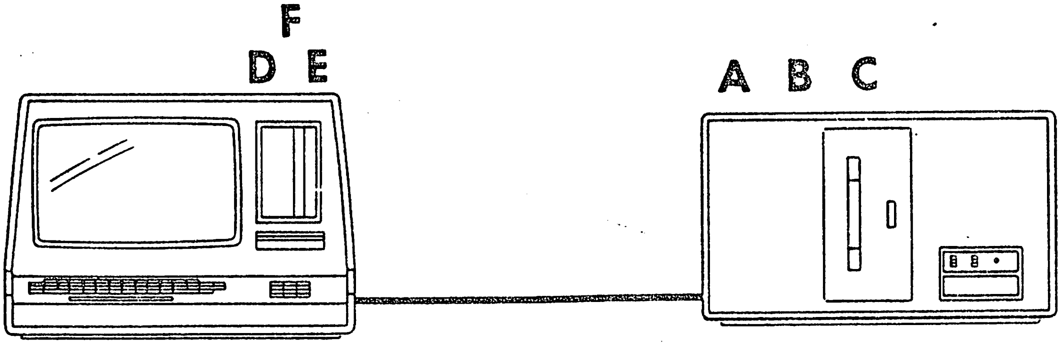




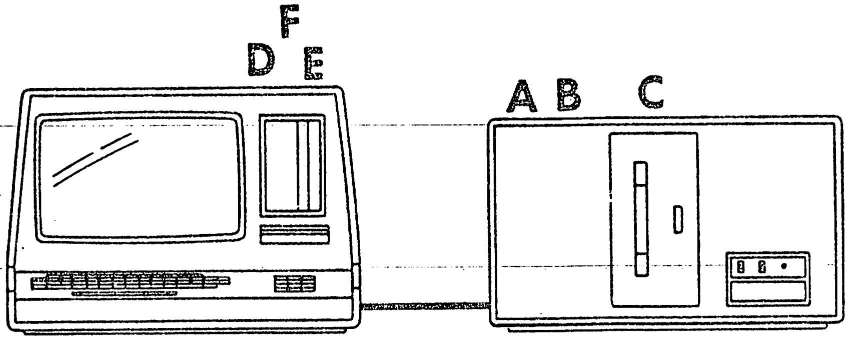
H/Z67 BOOT DEVICE



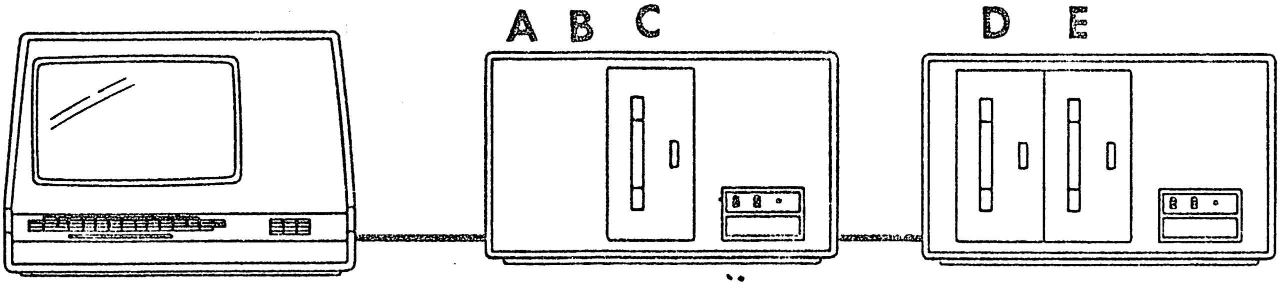
H/Z67



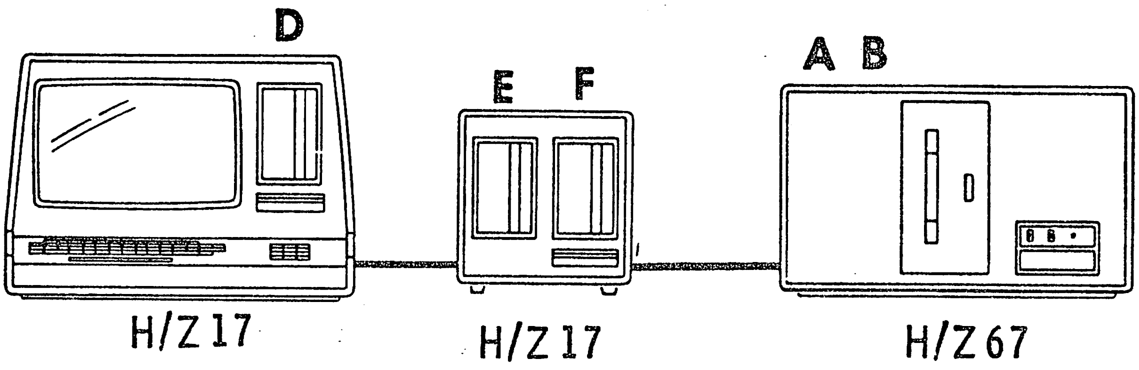
H/Z17 SINGLE DRIVE
H/Z67

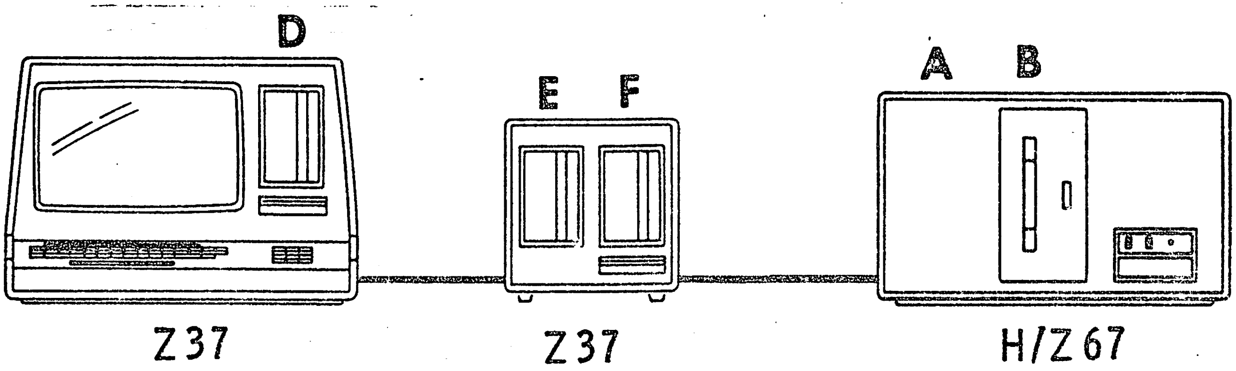


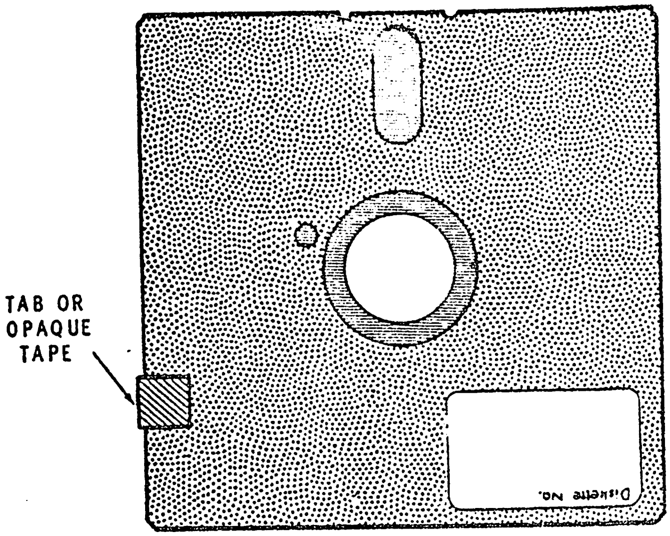
Z37 SINGLE DRIVE
H/Z67



H/Z67
H/Z47

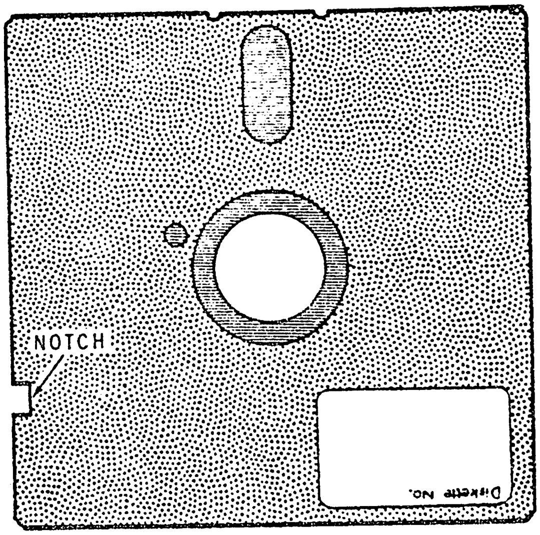

D
E
F
A
B
H/Z17
H/Z17
H/Z67


D
E
F
A
B
Z37
Z37
H/Z67



WRITE PROTECTED

FIGURE F-2



WRITE ENABLED

FIGURE F-3

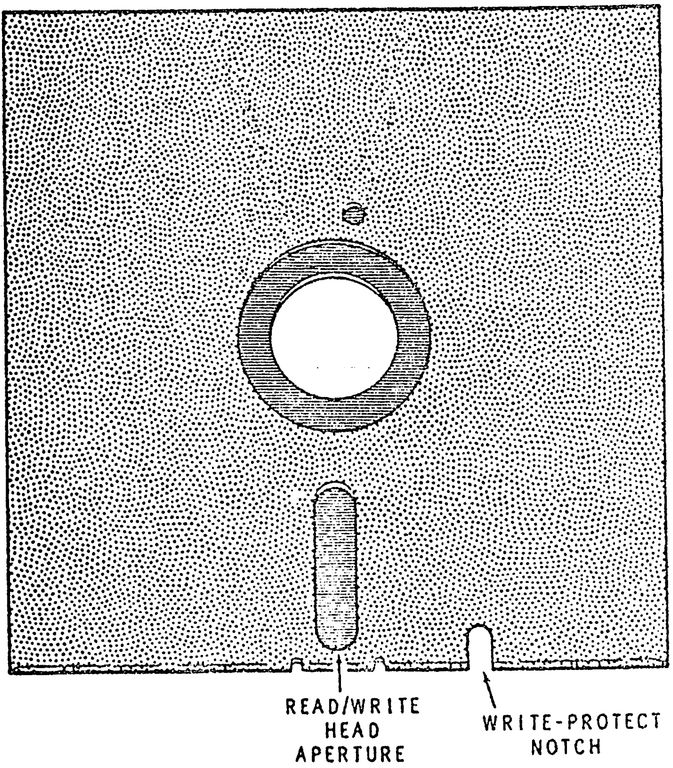


FIGURE F-4

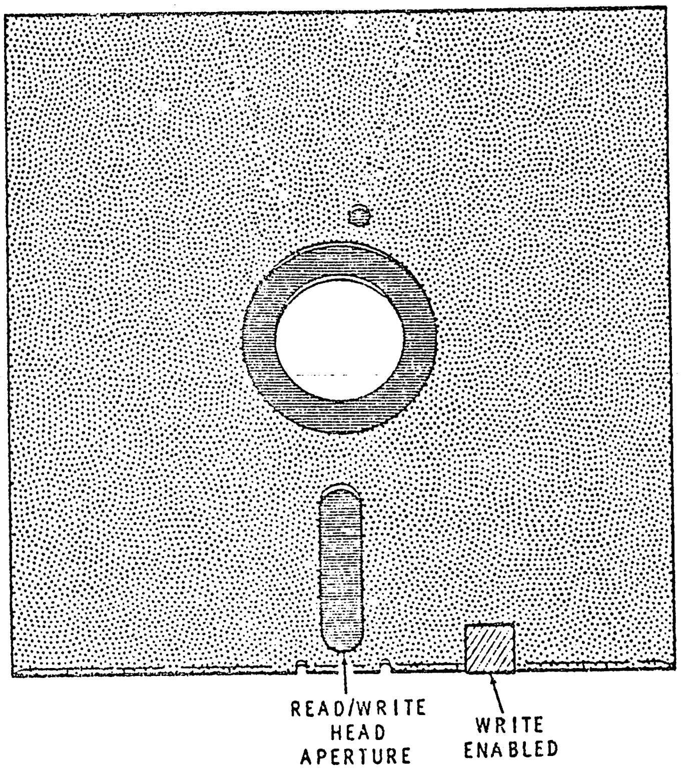


FIGURE F-5

```
      THIS IS A REF LIST OF WHAT IS ON CPM VOLUME I LESS LIST.COM
THIS?

A>DIR
   ASM      COM : ASSIGN   COM : CONFIGUR COM : DDT      COM
   DUP      COM : ED       COM : FORMAT   COM : LOAD     COM
A: MOVCPM17 COM : PIP      COM : STAT     COM : SUBMIT   COM
A: SYSGEN   COM : XSUB     COM : LIST     COM



A>THIS IS A REFERENCE LIST OF CPM VOLUME II
THIS?

A>DIR
A: BRS      COM : DUMP     ASM : DUMP     COM : LIST     COM
A: MOVCPM37 COM : MOVCPM47 COM : MOVCPM67 COM : PREL     COM
A: SETLP    COM



A>THIS THIS IS A REFERENCE LIST OF CP/M 2.2.03 VOLUME III
THIS?

A>DIR
A: BIOS     ASM : MAKEBIOS COM : MAKEBIOS SUB : PREL     COM
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